Smart Computing & CONSUMER ELECTRONICS
In Plain English
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May 2013
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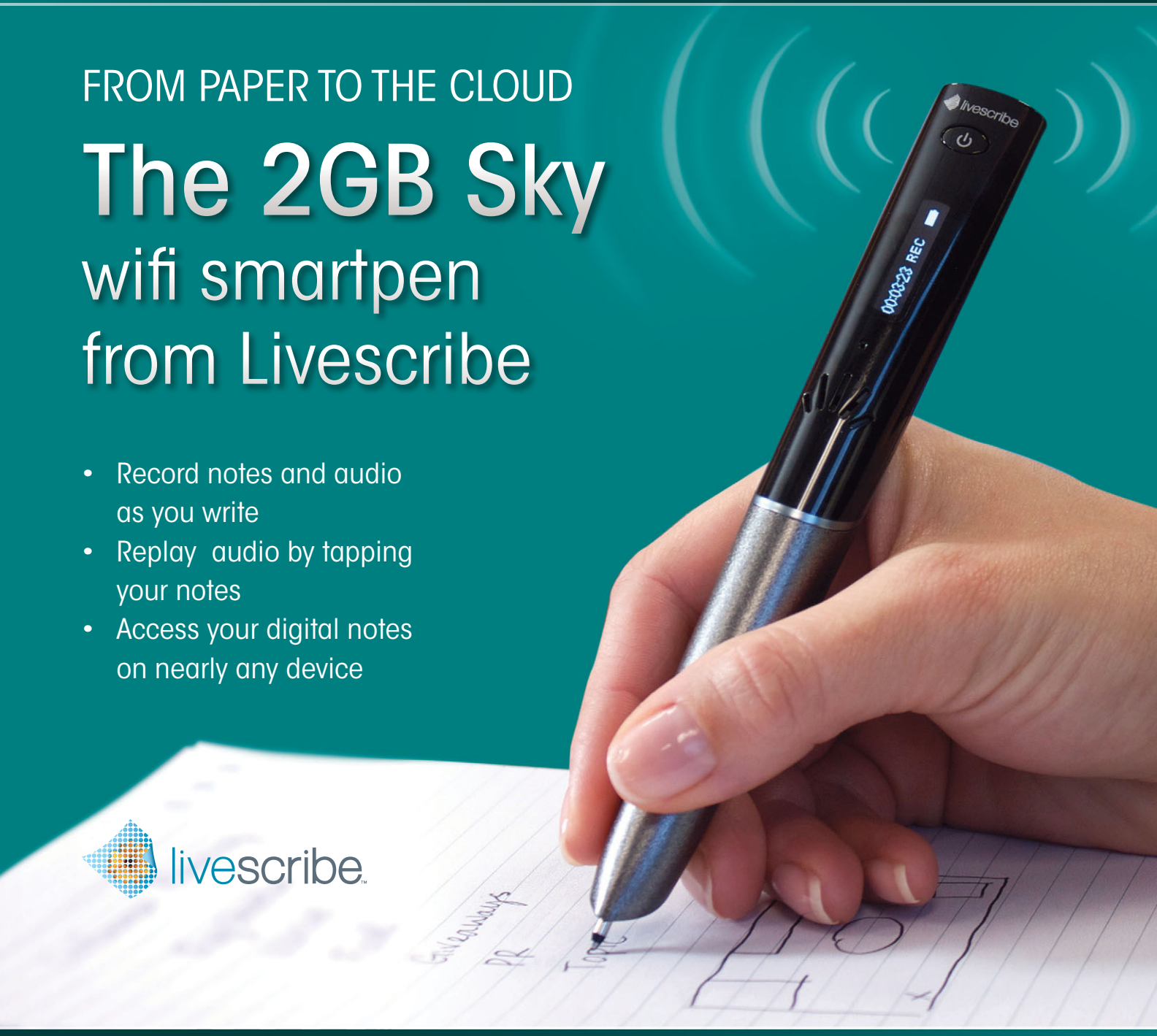
FROM PAPER TO THE CLOUD

The 2GB Sky wifi smartpen from Livescribe

- Record notes and audio as you write
- Replay audio by tapping your notes
- Access your digital notes on nearly any device

livescribe



TECH SUPPORT | Recover Deleted Files

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On The Cover See pg. 10

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News & Notes

Business Technology

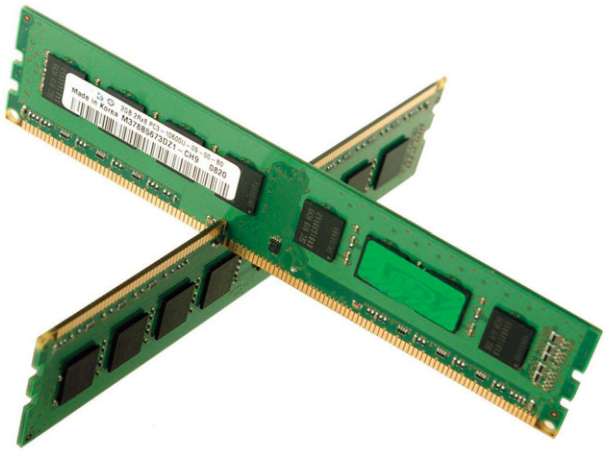
Personal Technology

Tech Support

Tech Focus

15 | Memory

As with most things in the world of technology, change continues unabated: One good thing about that continued change is that memory capacities have continued to climb, even as prices tend to drop. But memory is confusing. What kind does your system need? Where can you find it? How much do you need? Can you have *too much*? How do you install it? Or should you leave that to a pro? In this special section, we'll answer these and other pressing memory-related questions.



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Technology News

● Scanning QR codes may be getting more popular, but they're still far from common.

QR CODE SCANNING NICHE

Nielsen's latest report, titled *The Mobile Consumer: A Global Snapshot*, found that just 24% of American smartphone users said they scanned a barcode or QR code in a given month in Q2 2012. Compared to other smartphone activities, that's a fairly low number. Mobile banking and location-based services/GPS both ranked higher, with 38% and 48% of users saying they performed each at least once during the same month. QR code and barcode scanning did outrank NFC/mobile wallet use (3%), but most smartphones do not currently support this functionality.

MADE, DESIGNED, ASSEMBLED IN AMERICA

Harris Interactive recently surveyed consumers on their purchasing preferences and found that products perceived as "American" have a leg up in the hearts and minds of Americans, compared to those perceived as "foreign." The survey reports that 75% of Americans think that a product should be made in America to be considered American. In some cases, this means U.S. companies that have outsourced manufacturing don't make products that qualify. Approximately 52% think that products *manufactured by* U.S. companies can qualify as being American, 47% say a product's parts must be made in the U.S. for it to be American, and a one in four think "designed in America" is enough to make it American.

MOBILE TUG OF WEB

According to Jumptap, a mobile advertising firm, the tablet share of mobile Internet traffic is on an upward trend, but it will come at the expense of smartphone Web traffic. In 2011, Jumptap reports that 7% of the mobile Web traffic came from tablets and 17% from feature phones. In 2012, however, Jumptap found that tablets accounted for 18% of mobile Web traffic. Feature phone traffic had slipped to 4% over that period. Jumptap predicts that for 2013, smartphone traffic will shrink from 78% to 70% and the tablet share will increase from 18% to 29%.

Smartphones and tablets are taking over Web browsing and social networking tasks from PCs.

YOU'RE COMPUTING LESS ON YOUR PC

The NPD Group reports that 37% of users have replaced their PCs with mobile devices for a majority of their computing needs. For these users, Facebook and Web browsing are their primary computing activities. Other activities moving away from PCs and to tablets and smartphones include playing games, reading books and magazines, and posting and uploading photos. 21% of those surveyed also report that their Internet-capable TVs are taking over for PCs when it comes to video streaming from the likes of Netflix, Hulu, and similar services.

BETTER ONLINE SHOPPING

A new survey from The Boston Consulting Group asked consumers what three things online retailers could do to encourage them to buy more. An overwhelming majority of respondents (74%) agreed that free delivery was a big motivator. 50% of the survey respondents said lower prices would encourage them to shop more. The next best motivators include free returns (35%), more secure websites (25%), better virtual views of products (25%), insurance against credit card fraud (19%), and the ability to compare different products (18%). Less popular options include flexible delivery time and place, same-day delivery, and guaranteed delivery timing.

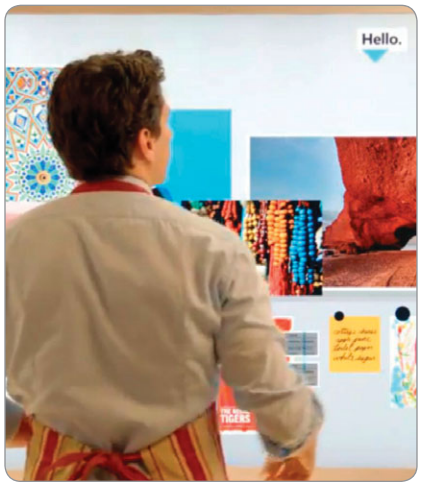
● Online shoppers love free shipping.

●Young people are *very* fond of their tablets.

SURVEYS SAY...

When it comes to surveys, sometimes you get better results when you simply poll the pollsters. This is what Econsultancy did with its Digital Marketing Outlook Survey. According to it, 66% of agencies polled believe that young people will make tablets their primary computing device. The survey also found that more than half of agencies (55%) think users will spend more time on fewer sites. The biggest consensus comes from the 88% of agencies that believe consumers will demand the ability to watch and listen to their media wherever they happen to be, on their TVs, PCs, tablets, and smartphones.

Windows News



● In the future, you'll be able to interact with all the devices in your home.

MICROSOFT'S VISION OF THE FUTURE

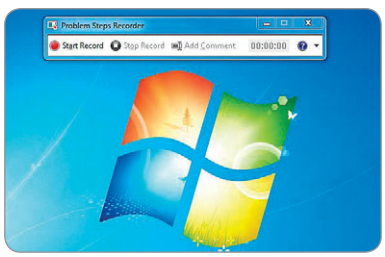
The physical and digital worlds will work together in the next several years, according to a video promoting Microsoft's new Envisioning Center. Most of the digital devices in your home will be connected to the Web and will feature touchscreens. In the video, all the connected devices are able to work together to accomplish a task. For example, you could select a recipe and have it projected onto a kitchen counter top. You'll also be able to video chat with friends and family, as cameras and microphones will also be built into most devices.

OFFICE 2013 LICENSE AGREEMENT CHANGES

Microsoft recently announced that it has changed its licensing terms for retail copies of Office 2013. Previously, you could only transfer the license to a new PC if the old one had failed and was under warranty. Based on customer feedback, the Office 2013 license agreement now allows you to transfer Office 2013 onto *any* new computer. The changes are effective as of early March, though the license agreement itself won't be changed until a future release. You can not transfer the software more than one time within 90 days, and any time you transfer Office 2013 or 2010, you'll need to remove the copy found on the previous PC. The retail copies of Office 2013 include the Office Home and Student, Office Home and Business, Office Professional, and standalone Office 2013 editions.

● LICENSE CHANGE

Office 2013 can now be transferred to another PC, thanks to changes to Microsoft's licensing terms.

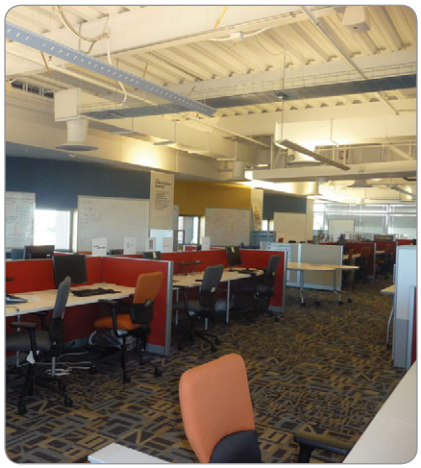


● This utility can capture an issue with screen shots and comments.

THE PROBLEM STEPS RECORDER

Looking for a way to help tech support people understand the problem you're having with a computer? Both Windows 7 and Windows 8 come with a Problem Steps Recorder utility that allows you to reproduce the issue by capturing text and screen shots. To reach the tool in Win7, just type **PSR** in the search field and select the Problem Steps Recorder (Record Steps To Reproduce A Problem). Click the Start Record button and continue through the steps you usually perform when the problem occurs. Once the issue pops up, click Stop Record, and save the recording. The image captures will be saved as a .ZIP file, which you can email to the appropriate tech support contact. You can also add comments to the record.

Business News



● The workspaces will be similar to this ASU Skysong co-working accelerator space.

ARIZONA ENTREPRENEUR RESOURCES

ASU Venture Catalyst is working with the Scottsdale Public Library system to provide co-working and expert fact-finding resources for small businesses and other entrepreneurs by delivering support within Arizona libraries. The pilot location in the Civic Center Library is up and running, with future locations soon to be added to what's being called the Alexandria Network. The ASU mentor network will offer additional expert support for advice and collaboration, as well as ways to connect with others.

WORK IN PROGRESS

Work In Progress is a Las Vegas-based co-working space with the mission of providing startups and creative thinkers with the tools to inspire creativity and innovation. There are now a total of three downtown locations, as Work In Progress has recently opened a new workspace on 6th Street. Member benefits include access to Work In Progress and partner events and worklounges with coffee and comfortable chairs for client meetings. Workspace options include shared desks, dedicated desks, conference rooms, and lockers for storage.

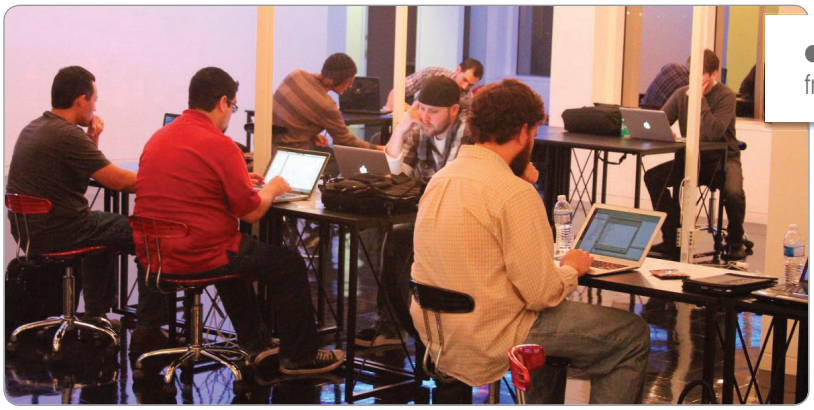
● LAS VEGAS CO-WORK

Work In Progress has three locations, with two others coming to downtown Las Vegas.

● The new centers can help you start or grow your small business.

RELAUNCH OF SMALL BUSINESS DEVELOPMENT CENTERS

The state of Connecticut recently relaunched 11 small business advisory centers, thanks to help from the state's Department of Community and Economic Development and the federal Small Business Administration. The 11 centers are now supported with a five-year program with a $11.6 million budget, and they are expected to open throughout the spring and summer of 2013. With the centers, you'll be able to meet with experts who can help you access your skills, knowledge, and drive to start a new business. Advisors can help you develop a budget, secure financial assistance, create marketing plans, and assist with licensing and procurement. Small business owners looking to grow their businesses can meet with an advisor to identify potential sources of capital financing. Expert knowledge is available to evaluate bottom line value, demonstrate value to customers, and identify new industry segments. Detailed support and direction is also provided for those who want to target new markets, merge with another company, or expand globally.



● Geekdom offers month-to-month membership and free mentoring from pros and existing members.

NEW GEEKDOM CO-WORKING SPACE

Geekdom is a collaborative environment that's designed for entrepreneurs, technologists, developers, designers, and other tech mavens. Geekdom recently announced a new location, GeekdomX, in San Francisco. It provides 15,000 square feet meant to house technology-based startups. The GeekdomX location will be able to connect with 600 Geekdom members in San Antonio. One unique aspect of Geekdom is that members must allot one hour per week or one workshop per month to educate other members about their expertise, which makes it easy for members to connect with the like-minded people around them. There are no long-term leases, and the spaces feature dedicated desks and offices.

WORDPRESS BUSINESS

WordPress.com has released a service designed specifically for the needs of small businesses. For $299 a year, you can invest in WordPress Business and receive access to all of WordPress's premium themes and enjoy unlimited storage for videos, images, music, and other website features—without any hidden storage or extra bandwidth costs. WordPress won't display any ads with the WordPress Business service. Folks with video-centric websites will also like the service's support for VideoPress, which lets you upload up to 1GB files with no cap on video length. Other key features include live chat support available M-F 9am to 5pm EST, a free domain, and custom design capabilities. A guided transfer is provided to make it easy to transfer an existing WordPress site to a self-hosted installation. An offsite redirect tool lets you bring existing visitors over to your new website.

● WordPress Business offers customizable design and unlimited storage for multimedia.

● SMALL BUSINESS EVENTS

Small business events give you a chance to learn critical management skills and network with professionals in related fields. Don't miss these upcoming opportunities. If you would like to see your event here, email editor@smartcomputing.com with the subject Small Business Event.

SOBCon Chicago 2013
Chicago, Ill. | May 3rd-5th, 2013
http://sobconchicago13.eventbrite.com/

Vendor Outreach Session
Washington, DC | May 14, 2013
www.hhs.gov/about/smallbusiness/events.html

The Small Business Expo (New York)
New York, NY | May 16, 2013
www.thesmallbusinessexpo.com/

National Small Business Week
Washington, DC | May 20th-26th, 2013
www.nationalsmallbusinessweek.com/

Veteran Entrepreneur Training Symposium
Reno, Nev. | June 10th-13th, 2013
www.veterantrainingsymposium.com

The Small Business Expo (Dallas)
Dallas, Tex. | June 20, 2013
www.thesmallbusinessexpo.com/

10th Annual Elite SDVOSB National Conference
San Diego, Calif. | August 21st-23rd, 2013
www.sdvobconference.com/

The Small Business Expo (Boston)
Boston, Mass. | October 17, 2013
www.thesmallbusinessexpo.com/

Small Business **Resources**

The Web has a trove of resources for SOHOs (small and home offices) and small businesses—if you know where to look. Find an association that can help you meet your goals; get information from the government about loans, grants, and taxes; and stay up-to-date with the best small business newsletters and blogs. If you have a pressing question, pose it on a forum to see what your peers have to say.

Associations & Support

Better Business Bureau
www.bbb.org
(703) 276-0100
4200 Wilson Blvd.
STE 800
Arlington, VA
22203-1838

Main Street Alliance (MSA)
mainstreetalliance.org
info@mainstreetalliance.org
(603) 831-1835
3518 S. Edmunds St.
Seattle, WA 98118

National Federation of Independent Businesses (NFIB)
www.nfib.com
(800) 634-2669
(615) 872-5800
53 Century Blvd.
STE 250
Nashville, TN 37214

National Small Business Association (NSBA)
nsba.biz
(202) 293-8830
1156 15th St., STE 1100
Washington, DC 20005

SCORE
www.score.org
(800) 634-0245
(703) 487-3612
1175 Herndon Pkwy
STE 900
Herndon, VA 20170

Small Business Development Centers Network (SBDCNET)
www.sbdcnet.org
(800) 689-1912
501 W. Durango Blvd.
San Antonio, TX 78207

Blogs

Signal vs. Noise
37signals.com/svn/posts

Small Business Search Marketing
www.smallbusinesssem.com

Small Biz Bee
smallbizbee.com

Small Business Trends
smallbiztrends.com

The Small Business Blog
www.sme-blog.com

The Entrepreneurial Mind
www.drjeffcornwall.com

Forums

Small Business Administration Community
www.sba.gov/community

The Small Business Community Forums
www.smallbusinessforums.org

Small Business Ideas Forum
www.smallbusinessbrief.com/forum

The Young Entrepreneur
www.youngentrepreneur.com/forum

Government

Grants.gov

House Committee On Small Business
smallbusiness.house.gov

Small Business and Self-Employed Tax Center
www.irs.gov/businesses/small

Small Business Administration (SBA)
sba.gov

U.S. Copyright Office
copyright.gov

U.S. Department of Labor
dol.gov

U.S. Senate Committee on Small Business & Entrepreneurship
sbc.senate.gov

Small Business **Development Centers**

Assistance For Entrepreneurs

Haven't the foggiest idea how to harness your entrepreneurial spirit, pull yourself anywhere using bootstraps, or think in or out of a box? Starting and running your own business is tough, but fortunately for prospective and current small business owners, SBDCs (Small Business Development Centers; asbdc-us.org) dispense with the clichés and offer training, counseling, and other assistance to help you craft your vision into a real-world success.

Run A Small Business

Pooling resources from federal, state, and local governments, as well as the private sector and the educational community, The Association of Small Business Development Centers is truly a joint venture with a vested interest in fostering small business growth. For an overview of what the SBDC can offer you and your small business, visit bit.ly/dKYe2a. The SBA (Small Business Administration; www.sba.gov) is partnered with SBDCs.

Help On Your Turf

You may be surprised to learn that there's probably an SBDC branch nearby; there are locations in all 50 states, in the District of Columbia, Puerto Rico, and even in the U.S. territories. There are 63 nationwide Lead Small Business Development Centers coordinating program services for every sub-center and satellite location in each state. Centers are made up of directors, full-time staff members, and various part-time staff and volunteers.

The best way to contact your nearest SBDC is to visit the Association of Small Business Development Centers' Web site (asbdc-us.org), input your ZIP code into the Find Your Nearest Small Business Development Center text box, and then click Go. The results page will highlight Lead Centers but rank centers in order of those closest to your location. Often, SBDCs partner with universities and colleges, and tend to be found on campuses across the country. On the search results page, you'll also find a link to the local office's Web page, email address, phone number, a fax number if available, and address.

Frequent Question

If you're like many other people starting a small business, funding is at the top of your mind. A common question that entrepreneurs have for SBDCs is: "Am I eligible for grant money?"

The answer depends on the nature of your business. Grants.gov (www.grants.gov) will give you a clear picture of your options before your visit to a Small Business Development Center.

The Closest Thing To A Free Lunch

The services offered may vary by location, but all SBDCs offer many services free of charge. Some typical services you canexpect from your nearest SBDC include help with financial, marketing, production, organization, engineering, and technical problems and access to feasibility studies that can flesh out a fledgling business plan. Some SBDCs also offer affordable training seminars to help with various aspects of running a business. You can also rest assured that your business with the SBDC will remain confidential.

Women's Business Centers

The SBA offers WBCs (Women's Business Centers), which directly serve female entrepreneurs through nearly 100 educational centers nationwide. This organization strives to assist women in overcoming the hurdles they face in today's business environment by offering business management training and technical assistance to all women, with a special emphasis on economically or socially disadvantaged women. The services and training programs are also commonly offered in multiple languages to enable those who speak English as a second language or are still learning English. To find your nearest WBC, visit bit.ly/hs3st2.

Small Business, Big Payoff

Small business owners know that achieving success is about taking risks, innovating, and making tough decisions day in and day out. Thanks to the services offered at the SBA, SBDCs, and WBCs, you're not on your own.

From Paper To The Cloud

Meet the 2GB Sky™ wifi smartpen from Livescribe

Now you can quickly and easily get your written notes, charts, diagrams, and drawings into your digital world, where you have access to them on almost any device, any time, anywhere.

The downside to handwritten notes is worrying about writing everything down while trying to hear and remember everything that was said. But not if you have the 2GB Sky wifi smartpen from Livescribe. It records everything you write, hear, and say, and it can automatically deliver captured content to your free online account.

Never Miss A Word

The 2GB Sky wifi smartpen can sync the sound it records with the notes you take. Let's say you're scrambling to keep up in a meeting or lecture and miss some important information. Just tap on your notes and hear the audio from that moment in time. Just want an audio recording of a meeting? Simply press a button on the pen to begin audio capture using the pen's built-in microphone.

Livescribe paper is covered with thousands of microdots that act like a map for your smartpen, allowing it to capture whatever is on the page, including drawings and graphs.

To Your Digital World

The smartpen's built-in Wi-Fi and seamless Evernote® integration makes uploads effortless. Even better, Livescribe provides you with an additional 500MB of monthly upload capacity, so you'll have plenty of space to store your notes and audio. To upload, just turn the smartpen on when you're within range of your home or work Wi-Fi signal. If you need the notes right away and aren't within Wi-Fi range, simply use the included USB cable to upload your notes.

The 2GB Sky™ wifi smartpen from Livescribe lets you access notes and audio when you need them, on the device you want to use.

The smartpen's 2GB of memory provides enough storage to capture 200 hours of audio and thousands of note pages. Livescribe includes a dot paper notebook with 50 sheets to get you started, as well as two ink cartridges and two smartpen caps.

Access Any Time, Anywhere

Integration with Evernote means that everything you upload will be accessible via any laptop, smartphone, or tablet. From Evernote, you can review your notes, audio files and pencasts (interactive "movies" of your synced notes and audio). Evernote also has tools that allow you to organize, search, and share any of your notes or entire notebooks.

Digitizing features, Wi-Fi transfer, broad device support, and Evernote integration make the 2GB Sky wifi smartpen the perfect accessory for your mobile lifestyle.

Selecting Your Next Computer From Tablet To Ultrabook™

Choose The On-The-Go Solution That's Right For You

Confused about what computer is best for you? This chart breaks down the functional differences among tablet, laptop, and Ultrabook™ options. As you can see, an Ultrabook™ provides you with the best of all possible worlds, as you'll enjoy best features of a laptop combined with the sleek design and portability of a tablet. Of course, you might want the PC for only a few specific uses, so check our chart to find out what's best for you.

What Are Your Needs?		Tablet 	Laptop 	Ultrabook™ 
Portability	Less than an inch thick	✓		✓
	All-day battery life	✓		✓
	Convertible styles	Detachable and wireless keyboard		Detachable, flip, slider, and swivel
Office Productivity	Email, video chat, and instant messaging	✓	✓	✓
	Full size screen & keyboard		✓	✓
	Efficiently create, edit, and multitask		✓	✓
Entertainment	Watch, play, and listen to multimedia	✓	✓	✓
	Smooth HD playback		✓	✓
	Wireless multimedia streaming	✓	✓	✓
Powerful Extras	Wakes up in a flash	✓		✓
	Speed boost when you need it		With an Intel Core i5 or i7 processor	✓
	Built-in security to keep files and identity safe			✓

Don't Forget To Check Out The New Intel®-Based All-in-One PCs

Stylish AIO PCs are another great space-saving option for those with office productivity and entertainment needs.

It's Time For A PC Refresh

There Are Some Things Your Old Computer Just Can't Do

The proliferation of social networking, HD video streaming, online file access, and other new applications has changed how we use our computers and what we demand of them. Can yours keep up?

Today's applications and websites demand much more from our computers than they did just three or four years ago. If you're tired of waiting for Web pages to load, applications to start, or files to open, it may be time for a new AIO (all-in-one), laptop, or Ultrabook™—one that can handle all the things you do today. Intel® technology is the driving force behind the best speed and performance features. Read on to see why now may be the best time to buy a new PC.

You'll enjoy a whole new world of possibilities with a new AIO, laptop, Ultrabook™, or tablet featuring Intel technology.

Perfect For Video

Consider how long it takes your current system to copy or burn videos. Many new Intel®-based AIO, Ultrabook™ systems, and tablets offer Intel's Quick Sync Video, which can convert video much faster than a PC built just four years ago. You'll also be able to enjoy HD video without any jitter, and crisp, clear surround-sound audio on many new Intel®-based PCs.

Touch Capability

Touch isn't just for smartphones and tablets anymore. Now you can enjoy fingertip access to your applications on AIO desktops and Ultrabook™ convertibles. The touchscreen also lets you control the PC with gestures: Scroll through your favorite websites with a swipe, zoom in or out using the pinch gesture, drag and drop with intuitive hand and finger motions.

Performance On Demand

Intel® Turbo Boost 2.0, available on many Intel-based systems, automatically ramps up processor performance when you run demanding applications. This ensures that your computer will be able to push a bit harder when necessary and still save energy when idle, providing you with longer battery life. You'll find Turbo Boost 2.0 technology on many new Intel®-based AIO desktops and Ultrabook™ devices.

No Waiting

Intel® Rapid Start Technology is another big time-saver, letting you go from standby to running applications in seconds. And to load files instantaneously, many Intel®-based systems include Intel's Smart Response Technology that remembers the data you access most frequently.

Built-in Security

Intel® Anti-Theft Service helps consumers protect their laptop and data from theft. This service uses Intel® Anti-Theft Technology built into the hardware to locate and lock a lost or stolen laptop. It is available on Ultrabook™ devices and 3rd generation Intel® Core™ powered laptops.

By The Numbers

How much faster is a new Ultrabook™ than a 4-year old PC?*

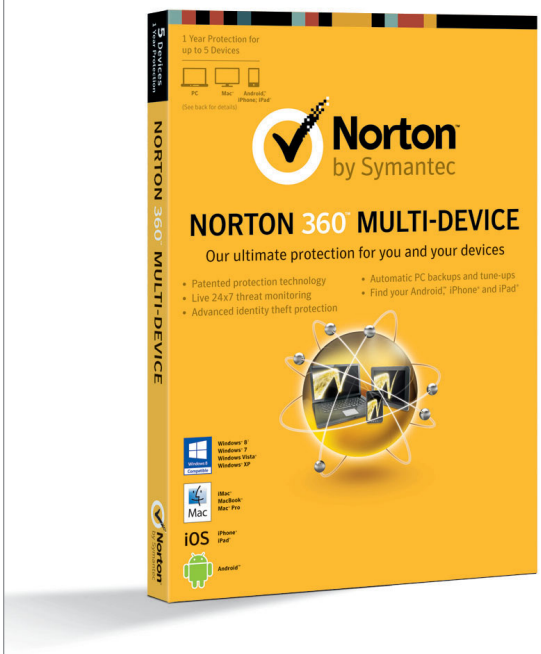
- **> 4x** faster resume from deep sleep
- **> 16x** faster 3D gaming performance[1]
- **> 3x** faster everyday computing[2]

*Software and workloads used in performance tests may have been optimized for performance only on Intel processors. Performance tests are measured using specific computers, components, software, operations, and functions. Any change to any of those factors may cause the results to vary. **As measured by:** [1] 3DMark* Vantage, [2] PCMark* 7 Score; **New Ultrabook™:** Intel® Core™ i5-3317U processor; **4-Year old system:** Intel® Core™2 Duo Processor P8600

www.norton.com

Ultimate Protection for you and your devices

Norton 360™ Multi-Device



$40 off
instantly at register for
Staples Rewards Members

Provides a single, integrated solution that protects you from threats and your mobile devices from loss

Norton 360™ Multi-Device brings together powerful PC, Mac®, Android™, iPhone®, and iPad® protection to deliver a single, straightforward solution that protects you on the various devices you use. With Norton 360 Multi-Device, there's no need to cobble together separate protection products on your own. It lets you safely surf, shop, share, socialize, and bank online, no matter which device you use.

- **EXCLUSIVE! Norton Protection System**: Our five patented layers of protection detect and eliminate PC threats more quickly and accurately than other technologies.
- **Network Defense Layer Protection**: Stops online threats before they can reach your computer.
- **NEW! Threat-Removal Layer**: Targets and eliminates hard-to-remove threats less sophisticated products often miss.
- **NEW! Scam Insight**: Reviews a website's reputation and lets you know if it is safe to enter your personal information, so you can be confident it won't be stolen by cybercriminals.
- **EXCLUSIVE! Norton Management**: Cloud-based controls let you install, manage, fix, update, and renew Norton 360™ Multi-Device on all of your devices over the Internet with a few simple clicks.
- **EXCLUSIVE! Parental Controls Management**: Lets you access Norton Online Family through Norton 360.
- **Norton Identity Safe**: Remembers, secures, and automatically enters your user names and passwords for you.
- **Automatic Backup**: Backs up your photos, music, and other important files only when you're not using your PC, so it won't get in your way and you don't have to remember to do it.
- **PC Tuneup**: Fixes common computer problems, frees up memory, removes unnecessary files, and cleans up your hard drive.

Norton by Symantec

PayX
Direct Deposit (ACH) enable

VersaCheck® X1 GOLD

SAVE 50-80% or more on checks and electronic payments!

Pay and Get Paid - Anywhere, Anytime!

Total Payment Automation for Home and Office

- ☑ Create checks and electronic ACH payments*
- ☑ Accept payments with no transaction fees
- ☑ Use stand-alone or with QuickBooks®, Peachtree and other accounting software
- ☑ Manage your finances

NEW!
Pay and Get Paid by Checks, eChecks and ACH **anywhere, anytime.**

VersaCheck® - The Complete Payment Solution

☑ Card Processing

☑ Mobile Processing

☑ **DNA** Secure Check Processing

*Visit www.**VersaCheck.com/sc5** for details or call 303-532-4738

All About Memory

A Memory Primer

Memory is one of the key components in our computers, storing most of the data used by the processor to run applications. If there's too little memory available for the job, that data will be temporarily placed on a storage device (such as a hard drive or solid state disk) in your PC.

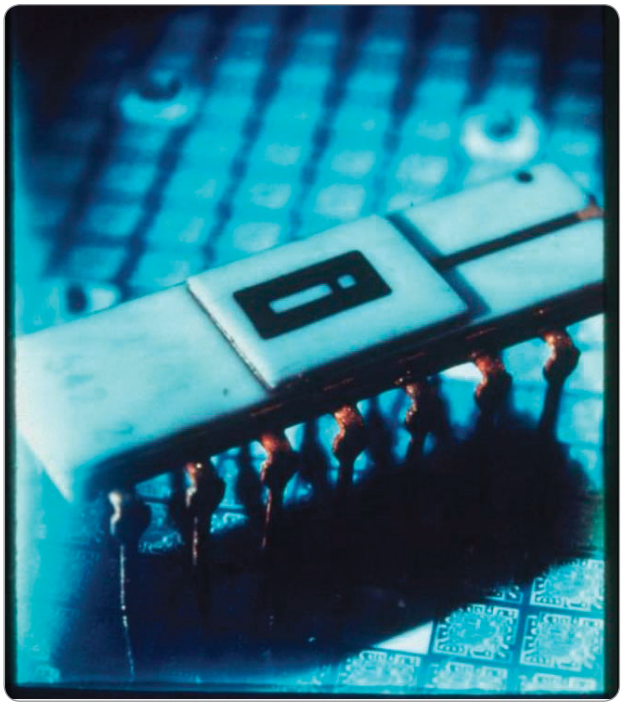
Moving data from a storage drive is typically much slower than transferring it from memory, so more memory is almost always better than less. We'll examine why that's so and talk about the different types of memory available.

How Memory Works

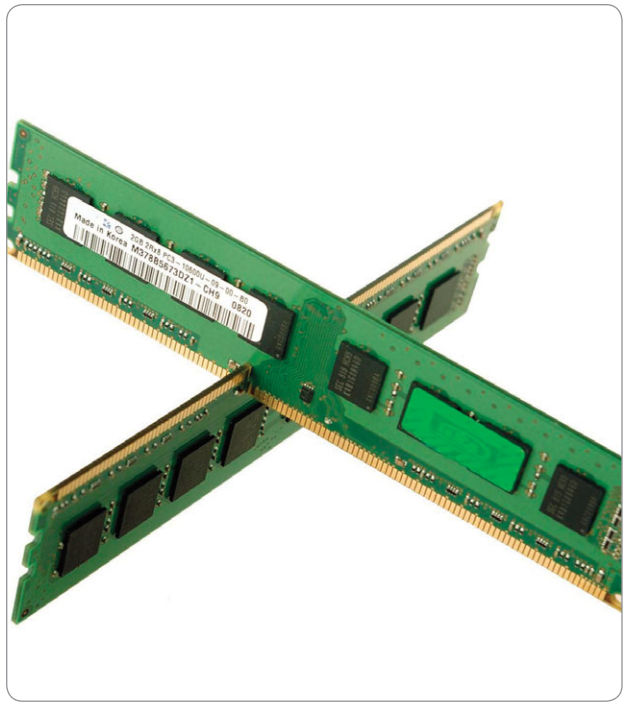
System memory, also known as DRAM (pronounced *dee-ram*; dynamic random access memory), plays the role of messenger between your computer's CPU and its main storage, holding all the temporary data your computer needs to run programs and background processes until the CPU needs it or until it is written semi-permanently to the PC's main storage, generally consisting of a hard disk drive or SSD (solid state drive). For instance, when you launch Internet Explorer, the system copies all data related to the running of that program from the main storage to system memory. As you browse, system memory plays tag with your browser cache to alternately store and display the contents of your browsing session. When you launch another program, system memory loads data from that application, and any other applications you launch, as well as a multitude of background processes.

DRAM is often described as *volatile* storage, because it relies on power from the computer to store the data in its circuits; when the computer is shut down, any data stored in volatile memory will be lost. (Compare this to SSDs, which utilize a nonvolatile flash memory, so any data stored in the drive will be saved—even if the computer has no power.) In modern DRAM memory modules, each bit of data is stored in a capacitor on a circuit board. The capacitors are incredibly small—billions of bits fit onto a square inch of the board.

To store data onto the module, a charge is sent to the circuit, which activates transistors at key intersections along the circuit board. The charge provides each capacitor with a data value; generally, a charge level of less than 50% is a 0, while anything else is a 1. The processor can read this in-



This chip from Intel revolutionized memory in computers. *Image courtesy of Intel.*



DDR SDRAM was found in PC's built at the turn of the millennium.

formation and pull whatever's relevant to the task at hand. Think of the data stored in the memory module as a series of mailboxes. Each capacitor has an identifying number, much like a mailbox could be matched with a house address. And like a mailman picking up a letter, the processor will take the data and direct it where it's supposed to go.

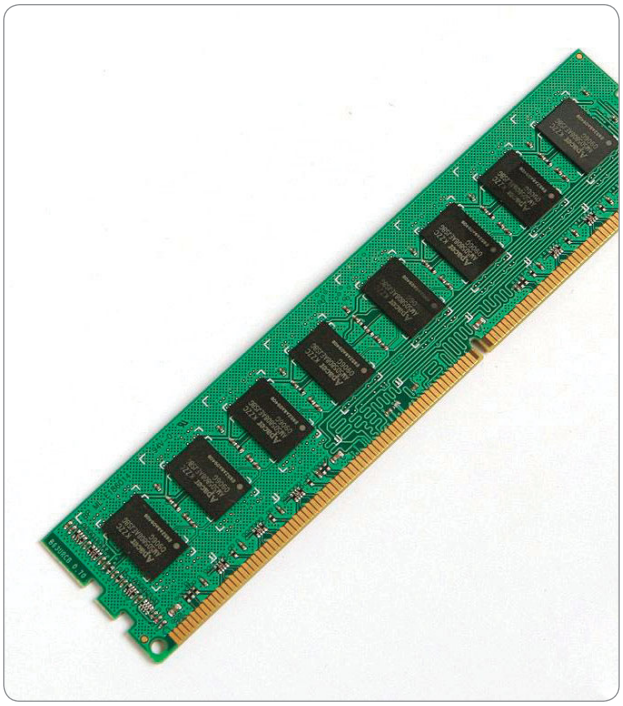
A Brief History Of Memory

The roots of today's DRAM technology began in the late 1960s and early 1970s when Intel released the first SRAM (static random-access memory) and DRAM memory chips. Before Intel designed the circuits, computers used different technology to perform memory functions. One of the earliest memory devices was found in the ENIAC (Electronic Numerical Integrator And Computer; arguably the first electronic computer) in 1945. It featured thousands of vacuum tubes and information was passed down a mercury-and-nickel wire delay line. Another popular option was core memory, unveiled in 1952 at MIT. It consisted of a material that could be magnetized in one of two directions to hold a bit of information. Core memory was the dominate technology until the mid-1970s, when Intel was able to make DRAM commercially available.

The chip that changed everything was Intel's 1103, a DRAM chip that could hold up to 1024 bits. Although it seems small now (a modern 4GB module holds 34 billion bits), the Intel 1103 provided opportunity for growth in the PC market, because production costs for DRAM were much less than that of core memory. Intel's 1103 DRAM was also capable of refreshing that 1024 bits every two milliseconds.

Types Of Memory

Today's desktop PCs use SDRAM (synchronous DRAM) memory modules, while most laptops use SO-DIMMs (small outline dual in-line memory modules). The difference between the two is that SO-DIMMs offer a much more compact design that's ideal for portable devices. SDRAM is generally more affordable than a comparable capacity SO-DIMM, because SDRAM is easier and less expensive to manufacture. Memory modules are also differentiated by the type of interface they feature such as DDR (double data rate), DDR2, and DDR3. Most PCs made in the last few years use DDR3 memory.



DDR2 memory offered a lower voltage and faster speeds than DDR technology.

Modern high-end DDR3 memory, such as Corsair's Dominator Platinum lineup, may include heat spreaders to help remove heat.

At the recent International Solid-State Circuits Conference, DDR4 DRAM was one of the hot topics. Initially set to be launched in the server market sometime in 2013, DDR4 is expected to utilize lower voltages than DDR3, with requirements forecast to be around 1.2V. Similar to the change between DDR2 and DDR3, DDR4 will feature a different number of pins, so it won't be backward-compatible with current DDR3 motherboards. That said, DDR4 isn't expected to attain a large portion of the memory market until 2015, according to a recent report from iSuppli Research.

Modern Memory Capacity

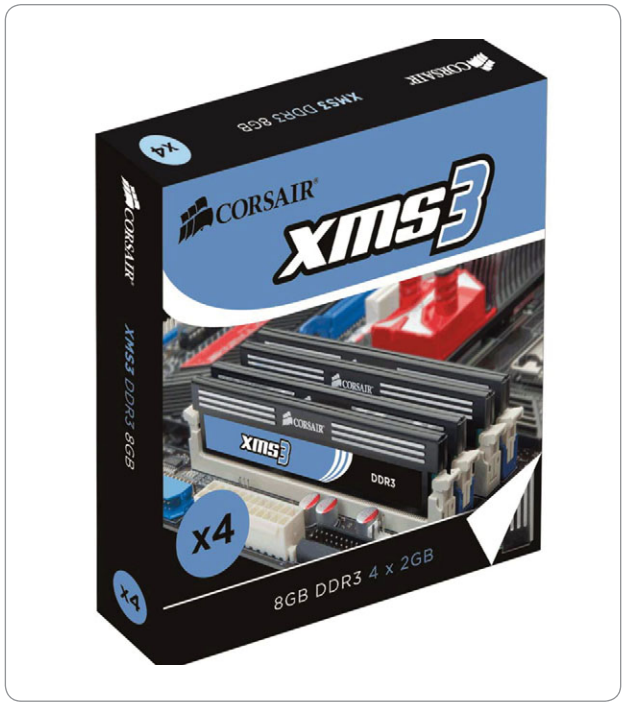
There are three limiting factors when it comes to system memory capacity. The first is the current peak capacity of memory modules available, and the second is the number of memory slots available in your motherboard. As of this writing, 2GB, 4GB, and 8GB modules are widely available. Most mid-range motherboards come with four memory slots and low-end models can have as few as two. That means that on your average mid-range motherboard, you'll be limited in practice to 32GB of

DDR Differences

The primary differences between the three DDR types are speed and power efficiency. This chart shows you how memory technology has evolved over the last decade. Peak transfer rate numbers are listed in MTps (megatransfers per second). Note that despite the tremendous speed increases, operating voltage has continuously dropped. The more energy-efficient modules help to reduce the power and heat created by the RAM in your computer.

DRAM Standard	Peak Transfer Rate	Operating Voltage	Primary Years Of Use
DDR	3200	2.5V	1999-2004
DDR2	8533	1.8V	2005-2009
DDR3	24,000	1.5V	2009-Present

SO-DIMMs are the type of memory you'll install in notebooks.



Memory is often sold as a kit, such as this set of four Corsair XMS3 modules, to take advantage of multi-channel support in motherboards.

system memory, and low-end motherboards will be limited to 16GB.

The third limiting factor is your operating system. 32-bit versions of Windows recognize only capacities of 4GB or less. To determine if you're running a 64-bit or 32-bit operating system in Windows Vista/7, click Start, right-click Computer, and click Properties. Look at under the System Type heading and you'll see whether you're running a 32-bit or 64-bit operating system. If you're running Windows 8, press the WIN+X keys to bring up the Power User Menu. Then, move your pointer to the bottom left corner of the screen and right-click. Select System and look in the System Type section. If you see "32-bit," then stick with 4GB of memory. If you see "64-bit," then feel free to purchase 4GB or more.

Check Your Speed

The faster the memory, the more quickly data will transfer in and out of the RAM. However, you must select a speed that's compatible with your desktop or laptop. (The speed will be noted as part of the label in designations such as DDR3-1333.) The user's manual for your PC or motherboard should list a maximum speed, as well as a maximum capacity and max number of modules. Memory manufacturers measure the speed of memory modules in both MHz (megahertz) and MTps (megatransfers per second). For instance, a DDR3-800 module has an 800MHz data transfer rate. The same module may also be listed as PC3-6400, which tells you that it has a theoretical bandwidth of 6,400MTps.

Memory is also offered in kits that allow you to improve performance by purchasing identical modules. Kits are available for dual-channel (two modules), triple channel (three modules), and quad channel (four modules). The takeaway here is that it's better to replace all of your old memory modules instead of simply adding more, one stick at a time; doing so allows you to ensure that the new memory modules are well-matched. Keep in mind that the motherboard in your PC must also support a given channel configuration, so check with your user's manual to find out what kit would be best for your system.

In the upcoming pages, we'll cover how to install memory and the difference between memory and storage, and we'll also give you some troubleshooting tips—you know, just in case.

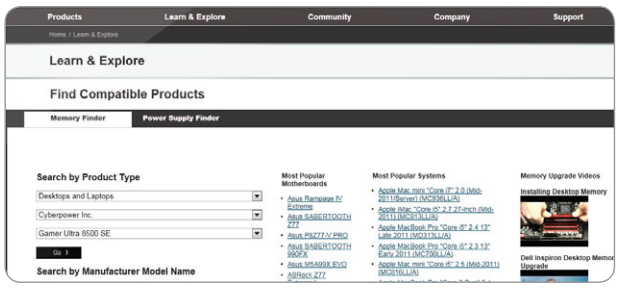
How To Install Memory

A Step-By-Step Guide For Desktops & Notebooks

When a computer's memory falters, tying a string around your finger (or the mouse cord) won't help much. But don't fret; installing new memory is one of the least expensive ways to improve your PC's performance, and it's a whole lot easier than you may have thought.

You've probably heard that upgrading memory can speed up your PC. That's certainly true—as long as the sluggish performance is due to a system memory shortage. As soon as your PC runs out of available system memory, it turns to *virtual memory*, which is just a fancy way of saying that the main storage (a hard drive, generally) will now act, temporarily, as system memory. When this occurs, you'll notice a dramatic slowdown, because reading and writing data from and to a drive is incredibly slow. The hard drive, and even its faster sibling the SSD, were not built to be read and written to constantly as you open new programs and manipulate files during your computing session.

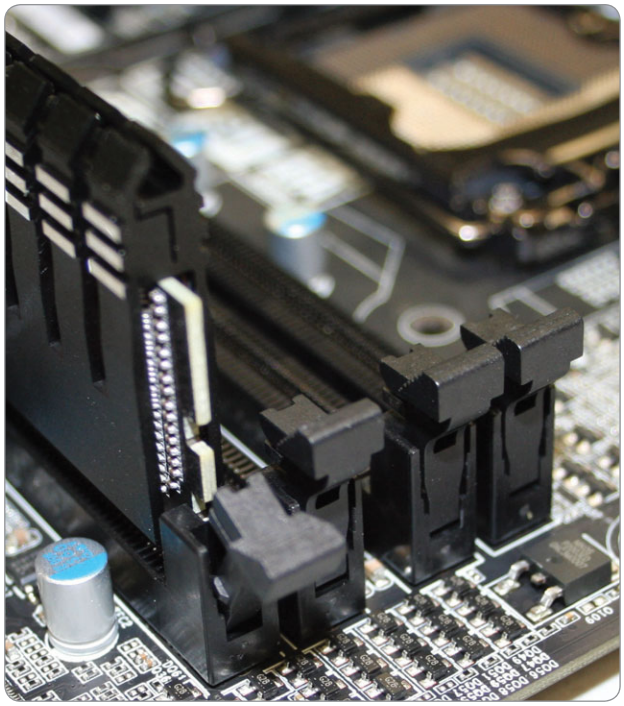
Your PC may need a system memory boost if performance appears to slow down as you launch more programs, if your PC is more than three years old and has not already had a system memory upgrade, or if you know that running multiple applications simultaneously will bog down your system. If you have plenty of system memory already, your problem probably lies elsewhere; upgrading to slightly faster modules will only marginally improve your overall PC performance, and you may not even notice the difference.



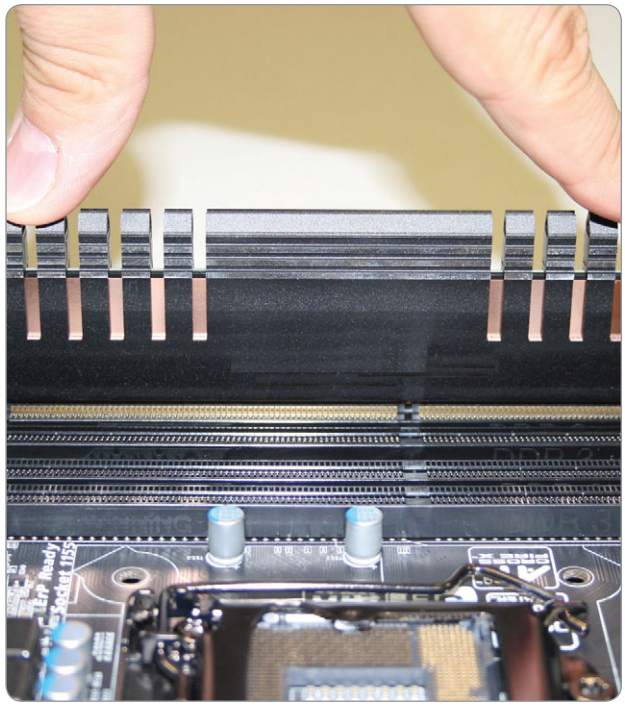
The Corsair Memory Finder utility can help you find memory modules that will match up with your PC.

Find The Right Memory

If you read our intro piece, you'll know that there are a number of things to consider when investing in new memory. One of the easiest ways to find compatible



Verify that the locking tabs are disengaged before removing the old RAM modules.



Insert memory by pressing down firmly until the tabs click shut.

memory is to check on a memory vendor's website. For example, Corsair provides a Memory Finder utility (www.corsair.com/us/learn_n_explore/) that you can use to select modules that will meet the specifications of your PC. Just select your name brand PC or motherboard from the drop-down menus, and Corsair will display a list of modules that will work with your existing setup. Naturally, most other memory vendors offer similar tools.

Install Memory Into A Desktop PC

Begin by powering down the computer and removing the power cable. Remove the case side panel to access the motherboard; make sure to discharge any static electricity by touching a metal portion of the case before touching any of the internal components. (Better yet, use an anti-static mat or wristband.)

Next, locate the DIMM slots on the motherboard. They're typically labeled as such; they're long and narrow and generally appear adjacent to the processor socket. To remove your existing memory modules, press your thumbs firmly on the tabs at either side of the slot so that they rotate away from the edges of the module. Also, before inserting the new memory, make sure to unlock these tabs on any empty memory slots you plan to fill.

Now, unless you plan to fill all of the memory slots, you need to determine which modules should go into which slots. For instance, if you are installing four modules, and you only have two matched pairs of system memory, you'll want to make sure each matched pair is running on one channel. There's no hard-and-fast rule here; motherboard manufacturers occasionally group slots that correspond to the different channels together or use different-colored slots to denote channels. The only way to know for sure is to consult your motherboard or PC manual.

With the new memory in hand, line up the notch in the module with the key in the slot, and then gently but firmly press straight down on the new module until it slides into place. The tabs should engage once a module is fully inserted, but press them inward gently if this does not occur. Repeat this process for each new module you install.

Finally, replace the cover on your PC, reattach the power cable, and plug it into the wall socket. When you press the Power button, your PC should boot and recognize the new memory immediately. To verify that your new memory is there and is being recognized by your system, click Start, right-click Computer, and

Using a mini Philips screwdriver, you should be able to remove the back cover of the laptop panel.

Place the memory at a 45° angle and press down until the retention clips have locked onto the memory.

click Properties. Look at the right side of the window under the Installed Memory heading, and you will see the capacity of your system memory.

Replace Laptop Memory

Most laptops offer only two slots for RAM, and you may have to remove one or both of the existing modules in order to increase the overall amount of memory in your notebook. For example, if the maximum capacity of the notebook is 4GB and it features one 2GB and one 1GB module, you'll have to remove the 1GB stick and install a 2GB stick in its place to increase the amount of RAM.

To see how many modules are installed on your notebook, begin by turning off the unit, unplugging it from the wall outlet, and removing the battery. (This way, you won't feel any jolts of electricity while you're working on the system.) Next, use an anti-static wrist strap or ground yourself by touching a nearby piece of metal before you touch any of the internal components. This will help prevent the static electricity in your body from shorting out the notebook's hardware.

Next, flip over the laptop and locate the small panel covering the RAM. Typically, the cover is two or three inches wide. The owners manual or manufacturer's website will indicate exactly where it's located. To open the back panel, you may need a mini Philips-head screwdriver. (Note that with some notebooks, you may need to use a flathead screwdriver to lift up the keyboard and access the RAM from slots beneath the keyboard tray.) After you've opened the panel, spread the clips on the side of the module and the stick should spring up. Grab the module by the sides and gently lift.

If there's a second module, go ahead and remove it as well. Examine the RAM to determine if one of the sticks features a smaller capacity than the other; that way if you're keeping one of modules, you'll know which one you'll want to reinstall in the laptop.

With the case open or back panel removed, ground yourself and then pick up the new module by the sides. Locate the open slot (or slots) and insert the SO-DIMM at a 45° angle. Move your finger to the back of the printed circuit board, and push down until the nearly all of the gold pins are in the socket and the retention clips have grabbed the memory. If you have a second module, repeat the process. Replace the back panel and install the screws.

Troubleshoot Memory

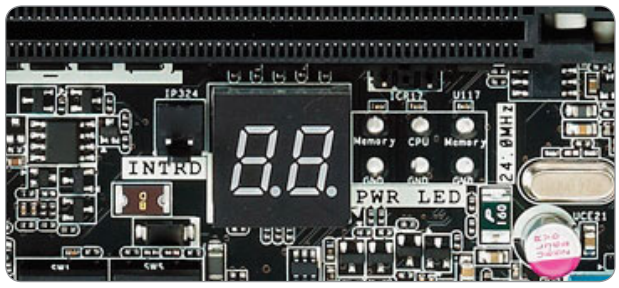
How To Narrow Down The Problem

System memory, or RAM, is just as important as the CPU or motherboard to a PC's operation. Fortunately, memory is generally a dependable component, because the technology is comparatively simple. Still, problems occasionally occur. We'll cover some ways to define (and defuse) potential memory issues.

Damaged memory is most likely to trigger crashes during memory-intensive operations, such as when you're installing Windows, compiling video, editing photos, or playing video games. Data stored in RAM can also become corrupted, resulting in errors in your applications or in Windows. With more severe memory damage, non-demanding applications, such as your Web browser or word processor, may unexpectedly close or Windows may restart when the computer is idle.

You Can't Handle The Power

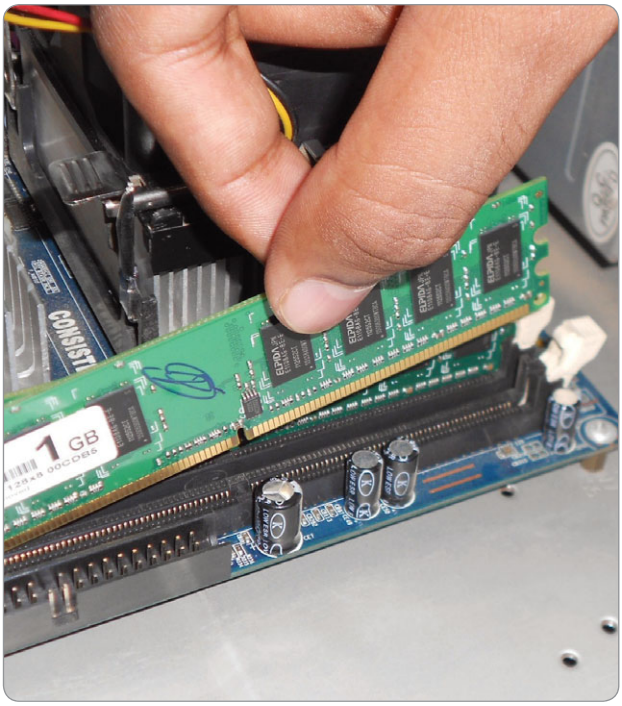
The DRAM (dynamic random access memory) chips on memory modules are very sensitive to electrostatic discharge. A static shock, even one so slight you can't feel, could release enough energy to ruin the microscopic transistors in the memory. Before touching any PC components, be sure to ground yourself, or attach an antistatic wrist strap that will help to prevent static discharge. Of course, power surges from the wall can have the same effect, which is why it's important to use a high-quality surge protector, preferably one with automatic voltage regulation.



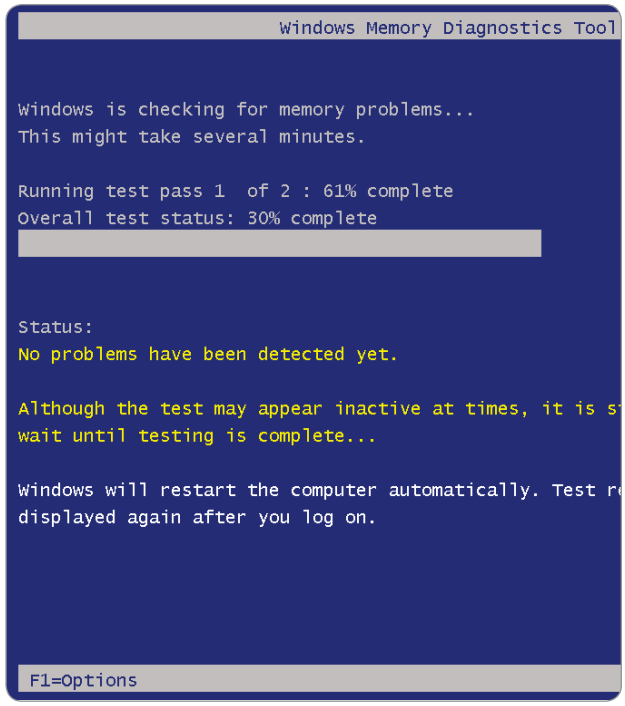
Some motherboards provide LEDs that display debug codes. The readout displayed may help if you suspect bad RAM.

Hardware Telltales

Sometimes you get lucky and the motherboard will tell you your memory is bad. This often happens early in the bootup process, while the system



Memory problems can result from a module becoming partially unseated, especially after the system has been moved or jarred.



Windows Memory Diagnostic can check for errors in your system memory.

is running its POST (power on self test). If the POST detects a bad memory module, the motherboard may emit a single, continuous (and very annoying) beep. Most BIOSes (Basic Input/Output Systems) will issue one or three short beeps, depending on what memory function is faulty.

Another way that some motherboards let you know about bad memory is with an LED (light-emitting diode) readout. This feature is sometimes found on higher-end motherboards. If there's a memory problem, the LED will display a code (the meaing of which is explained in the manual) pointing to the memory as the source of the problem.

General Troubleshooting

You should reseat the memory whenever the PC displays inconsistent, hard-to-reproduce system failures. Be particularly on the lookout for unseated memory if you've just finished an upgrade or otherwise moved the system around. You can tell that memory is unseated because the row of gold leads along the bottom edge will be partially visible, and it's likely that one of the two locks at each end of the memory slot won't be fully gripping the RAM module. Just to be safe, you can remove the modules and blow out their slots with compressed air to remove any stray dust or dirt that might be blocking contact points. Once you've removed the RAM, examine it for any cracks or other signs of trouble, such as burn marks. If the RAM is relatively new and you see any problems, you'll want to try returning the memory to see if it's under warranty.

It's also possible that a memory module is bad even absent any physical indications. You can use the Windows Memory Diagnostics utility built into Windows to test if the memory is faulty. To run the utility in Win7, click the Start button and enter **Memory** into the Start Search Bar. Under Programs, select Windows Memory Diagnostics. At the dialog box, you can choose Restart Now And Check For Problems or Check For Problems The Next Time I Start My Computer. Either way, you'll need to restart your PC to run the utility. For those running Win8, type Control Panel and select it from the Apps section. Click System And Security, choose Administrative Tools, and select Windows Memory Diagnostic. Choose Check For Problems The Next Time I Start My Computer and Windows 8 will do so.

Memory vs. Storage

What's The Difference?

Memory is also called RAM (random-access memory), because the data placed on the circuits in a memory module can be randomly accessed by the processor. The transfer method differs from data stored on a hard drive, where blocks of information are semipermanently placed in a specific location.

When the data stored on the drive is needed, it must be transferred to RAM, where it can be accessed by the processor—a much slower process than taking the data directly from the memory modules.

The Purpose Of Computer Memory

One way to think of RAM is in terms of a human's short-term memory. It stores the tasks and processes that the computer must use in the near future, often in mere milliseconds. And like our short-term memory, the things a computer places in the memory aren't designed to be remembered forever. Any data in RAM will be lost as soon as the computer shuts down. RAM is also very fast; the PC is free to continuously replace the information, which means you won't need to wait long for the processor to load data from the memory.

The more RAM in your computer, the more data your PC will be able to store for immediate access. That said, there's a functional limit to how much speed your PC will gain as a result of adding RAM, as most applications, including basic programs such as Web browsers, email clients, and multimedia players, won't use more than 4GB of memory at any one time. However, memory-intensive applications, such as image-editing and video-editing apps, can use much larger quantities of RAM.

A large kit of memory, such as this 16GB Corsair Vengeance kit, can help to ensure your PC always has enough RAM for the job.

SSDs are permanent storage devices that nonetheless utilize a form of flash memory.

As with SSDs, USB thumb drives use flash memory, but in this case, the technology is actually used for semipermanent storage.

The Purpose Of Computer Storage

If RAM is the short term memory, storage devices such as HDDs (hard disk drives) or SSDs (solid state drives) function as long-term memory. For example, the C: drive on most PCs is where Windows stores the files it needs to operate. When the computer starts an application, Windows gathers of all the information it needs to run the program by retrieving the necessary files from the drive where the application files were installed.

Flash vs. RAM vs. HDD

Portable flash drives are so-called because they use flash memory. Most USB thumb drives, memory cards, and SSDs use a type of flash memory that actually functions more like a traditional HDD than like RAM. Additionally, flash memory technology can produce storage capacities that are much larger than RAM—though not as large as the capacities of current HDDs.

Flash memory is also much slower than RAM, and current flash technology also wouldn't work as well as RAM for traditional memory processes because flash devices have a limited lifespan: Data can only be written to a flash cell a certain number of times—although that number is generally quite large, in the hundreds of thousands. Flash memory is a good alternative to traditional hard drives because an HDD is limited by the speed of the physical parts used to find and gather data. SSDs can access data roughly eight to ten times faster than hard drives, but large-capacity SSDs can be costly.

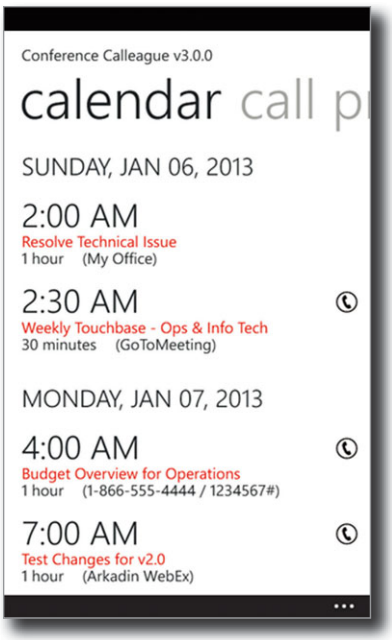
Why Go With A Memory Kit

Generally speaking, system memory is sold in sets of two (for dual-channel), three (for triple-channel), and four (quad channel). Matched memory modules have the same latency settings, speeds, and capacities to ensure the highest throughput. A system with dual-channel memory can read and write data to two memory modules at once. Some of the latest processors can also talk to three or four memory modules at once, and these are called triple-channel and quad-channel systems.

Mobile Marketplace

Business Apps *For Android & Windows Phone & iOS*

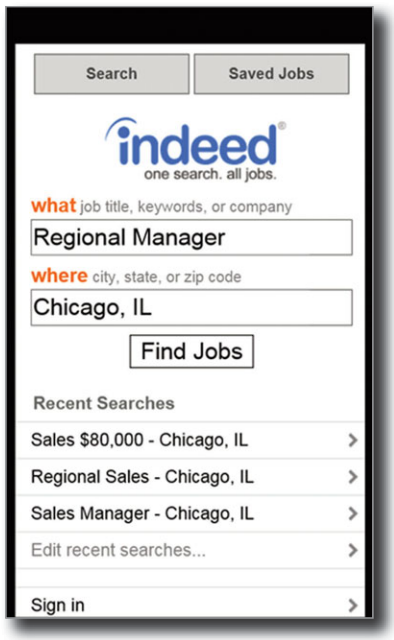
Some powerful business tools are floating in the sea of smartphone apps. Each month, we'll highlight some of the best ones for Windows Phone, iOS and Android platform users. (Unless otherwise noted, Windows Phone apps are available in the Windows Phone Apps & Games Store, Android apps in Google Play, and iOS apps in Apple's App Store.)



Conference Calleague

Windows Phone

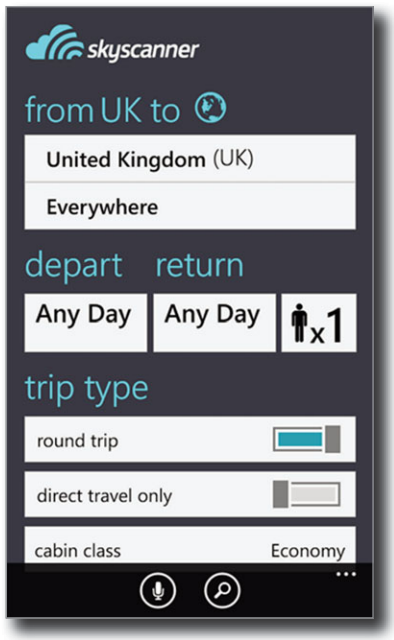
Conference calls are a great way to cut down on your travel expenses, but if you happen to be out of the office, attending a conference call can be a real hassle. With Conference Calleague, you can easily dial in right from your Windows Phone. This app lets you create live tiles for upcoming conference calls and then just tap the icon to join in—no manual dialing required. The Calendar Sync feature lets you keep track of all your conference calls and can pull in meeting phone numbers, bridge and room numbers, and passcodes from more than a dozen different call providers.



Job Search

Windows Phone

If you're looking for a new career, then you probably already know how powerful Indeed.com's job search capabilities are. With Job Search, you can continue your hunt right from your smartphone. This app lets you perform job searches using keywords, save searches, display new jobs since your last search, save or email individual job listings, and more. To get started, just enter a keyword or two into the What box, then input the location in the Where box. Then just click Find Jobs to start the next phase of your professional life.



Skyscanner

Windows Phone

If you're a frequent traveler, then you've likely found yourself waiting in line to rebook a cancelled flight. With Skyscanner, though, you don't have to wait for anything, just input your location, departure and return dates, number of passengers, one way or round trip, whether or not you want a direct flight, and your class preferences, and then click to search icon to find the best available flights. You can scroll through the results and book a flight based on price, duration, and more. We particularly like that you can click the microphone icon to speak your queries.

Guidebook

iOS

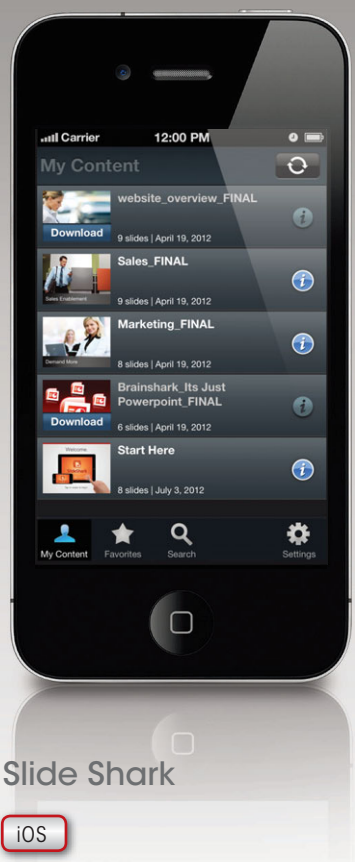
Guidebook was made for those of us who attend a fair number of conferences, trade shows, and industry events. Whether you do it before you leave or while standing in line to get your name badge, you can use Guidebook to find the show guide and download it to your iOS-based device for offline use. The app lets you access maps, floor plans, and contact information. We also liked that you can search for people, places, and more; check out the in-app Twitter feed for the latest information; and take photos at the event and share them in the app for others to see.

Image To Text

iOS

The powerful OCR (Optical Character Recognition) technology built into Image To Text from Ricoh Innovations lets you take photos of text documents and convert them into editable text documents. The app is easy to use: Simply take a photo or navigate to a photo from your gallery and the app generates a separate document with the text extracted from it. Once complete, you can send the image and text documents in email or post them to Evernote. Unlike some OCR apps, this one lets you use it without registering an account.

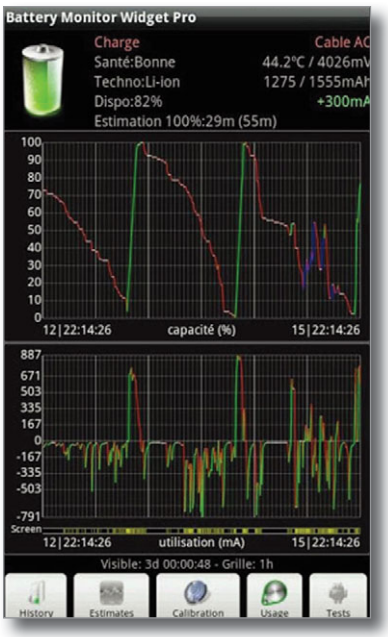
App Of The Month



Slide Shark

iOS

If you're often taking to the road with PowerPoint presentations in tow, then you probably assume you need your notebook to effectively show them off. But with Slide Shark, you can display your PowerPoint presentations flawlessly from your iPad or iPhone, with animations, fonts, colors, and graphics intact. Once you've created an account, you can upload PowerPoint files from your phone, tablet, or PC. Because it supports basic gestures, navigating slides is quick and intuitive. The app also lets you share the presentations and keep track of the file views.



Battery Monitor Widget

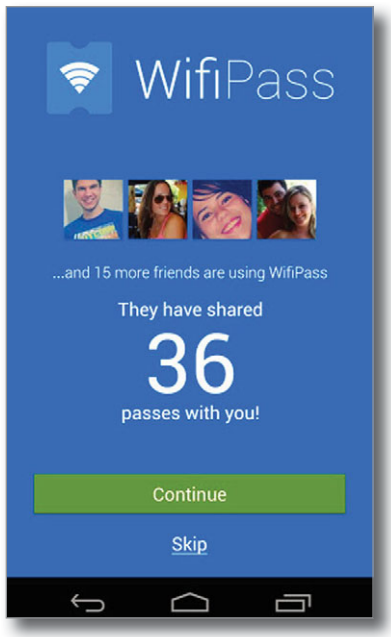
Android

If you're the type who wants to know the nitty gritty of your smartphone's battery life, then check out the Battery Monitor Widget, from developer 3c. This app lets you see the percent remaining charge, voltage, and temperature data as reported by Android OS. You can display the widget in a number of sizes (2x1, 3x1, and 4x1), add history markers on boot to help you determine if a particular app is draining the battery, and view a graphical representation of your battery usage to help you rein in your usage. We also like the variety of battery meters you can display on your home screen.

Credit Karma Mobile

Android

You already know how important your credit score is, but with Credit Karma Mobile, you can improve your credit rating, get your free credit score, and get other financial advice. This app is free, the credit report is free, and you can even get access to on-the-go credit monitoring without registering with a credit card. The app's Credit Report Card can also flag items on your credit report that negatively impact your score. The app also sends you notifications anytime there's a change in your credit report so you can mitigate credit card or bank account fraud before things get out of hand.



WifiPass

Android

If you have places at which you frequently use Wi-Fi, you can store your passwords and share them with your friends so they don't need to ask or type out the passwords to get online. Likewise, your friends can share their hotspot passwords with you to save you some time. You can even store your collection of Wi-Fi passwords in the cloud, so you have access to them wherever you go. The app also reminds you when you are nearby a Wi-Fi network for which you have a password. You can also tap into your Facebook friends list to establish new shares.

Time For A VPN?

They're Not Just For Big Companies Anymore

A virtual private network "tunnels" through the Internet, creating a secure link between remote computers and your home or office network.

You've probably heard about VPNs—virtual private networks: This is software that establishes a secure link to your home or office network so that you can access that network while on the road. When you use a VPN to log in to your office network, it feels as if you really were sitting at your desk back at your home or office. You have access to everything that you'd have back at the shop: programs, documents, email, printers, intranet, etc.

There was a time when VPNs were reserved for larger institutions: Sure, the CEO of a major insurance company could have a VPN. After all, he or she was part of a big company that could bring to bear technical and financial resources that were beyond the reach of a small-time businessperson running a 10-person company that manufactures widgets.

That's no longer true. VPNs are becoming more and more common, they're affordable, and they're easy to set up. In fact, you may already own all the software you need and not even know it.

What's a VPN?

Let's start with some basic background. A VPN is a secure connection that uses the Internet to set up a virtual "tunnel" through which you can connect to your network. (Ok, there's not really a tunnel. Here's how it actually works: Data is sent over the Internet in packets. A VPN encrypts each packet and then *encloses* it in another packet. That double-enclosure, coupled with encryption, serves to make the data doubly secure. Somewhere along the line, someone decided that this double enclosure constituted the virtual equivalent of a tunnel. Just go with it.)

Not only is the connection intended to be secure, it's also programmed to shut down and reroute the data packets if it's attacked. Remember that the whole point of the Internet is to provide multiple paths for data to follow: If one node (or a dozen nodes) goes down, traffic is rerouted to other

nodes; if those nodes are also non-functional, traffic is re-rerouted. This continues until it finds a workable path that allows the sender to get the data to the correct recipient.

This protection helps maintain the VPN's secure connection, but it can actually cause problems, some of which we'll discuss momentarily.

A VPN is an example of a "client-server" architecture. That may sound complicated, but it simply means that the VPN software itself runs on a server back in your office (or at a provider's, if you opt to pay a service to host your VPN), while each computer (or, these days, each mobile device) that connects uses either a Web connection or a small "client" application that knows how to communicate with the VPN software back home on your office server. So there are two parts to a VPN: the large piece that runs on the server and a freestanding app that's installed on each device and that knows how to communicate with the server.

Types of VPNs

When we talk about a VPN in a typical business context, we usually mean a remote-access VPN, such as we've been describing. If you have a home office and remote or traveling employees (salespeople, for example) who wish to access the office while on the road, this is the sort of VPN they'll use.

There's also another type of VPN, called a "site-to-site VPN." This one connects multiple fixed locations, say, a home office and its several branch offices. As you might expect, this sort of VPN really *is* reserved mainly for large companies, since it's meant to connect multiple fixed offices, rather than to link remote users to one office.

Blurring The Line Between Work & Home

Like smartphones, tablets, and the rest, VPNs encourage productivity; your employees (and yourself) can grab assets from (or deliver them to) the work network, no matter where they happen to be: a coffee shop, an airport, or a hotel room.

But there is a downside to all of this connectivity: The more we take advantage of it, the more we continue to blur the line between work and home.

Is that a bad thing? Well, it depends. You certainly want to get the most out of your employees—and one assumes that you appreciate the fact that they're willing to work from home or after hours. (And we further assume that you find ways to show that appreciation.) But some analysts have concluded that two thirds of U.S. employees work even during their vacations. That may help the bottom line in the short term, but the jury's out as far as what its effect might be over the long haul. Employee burnout is a very real (and costly) problem.

You may hear both types being discussed, but in the context we're considering here, you're more likely to be interested in the former type of VPN than in the latter.

Hosted Or In-House?

If you're already running servers at your place of business, then adding a VPN server is no big deal—especially if you happen to have an in-house tech person to handle the nuts and bolts. If you're a three-man (or –woman) shop, then you may not have any tech help, nor any real servers, other than something that serves as shared storage for files that might be needed by multiple people. If that's the case, consider going with a hosting company. There are dozens of reputable hosting services; in fact, you may already be utilizing a hosting company—perhaps for your website, company blog, or intranet—that also offers VPN hosting services. Check to see if they offer services of which you're unaware. (If nothing else, they can point you to VPN hosting companies that might be worth checking out.)

Potential "Gotchas"

We're talking technology here; that means that there is, as always, the potential for problems. The two most common problems manifest themselves as a very slow connection, though their causes differ.

Keep in mind that when you connect via a VPN, it feels as if you're on the office network—but you're not. You're someplace far away, and every time you send a request to the server at home, it must upload data to you from the VPN server. (Yes, you're downloading that huge Photoshop file, but from the perspective of the server, it's an upload.) That matters, because while you may have excellent download speeds at home, your provider's upload speeds are typically less (often *significantly* less) than its download speeds.

We're talking technology here; that means that there is, as always,the potential for problems.

If you own and use a copy of Windows Server, you may already have all the VPN software you need, since that functionality is included with many versions of this popular server package.

If you're trying to make this work with large files and inadequate upload speeds, you'll have trouble, and that trouble will show up as an excruciatingly slow VPN connection. (The lesson here? Check with your provider to see what your upload speed should be. Then test to make sure that's actually what you're getting.)

Then there's the problem of wiring. Old buildings may (and often do) have old wiring. If the wiring in your office (or the wiring to which your office connects) is several years old, you may find that your connection will drop packets. But that's not the real problem. The real problem is that your VPN software may interpret those dropped packets as evidence of an attack, and will then shut down the connection and attempt to reroute the communication. If packets continue to drop, the VPN may continually shut down, restart, and (attempt to) reroute the packets. If that happens often enough, the VPN connection may become so slow as to be useless. (The lesson? Check your wiring—all the way out to the Internet connection—and don't invest any time or money in a VPN until you're comfortable that it will be communicating over wiring that's in decent shape.)

Where To Buy A VPN

Trust the specialized vendors and the business equipment stores, such as Staples. They have the equipment you'll need, the personnel to explain how to use it, and the expertise to steer you in the right direction.

If you don't have an IT person on staff, it might be worth contracting with one to help set up your VPN. On the other hand, if you're planning to go with a hosting service, they'll do almost all of the heavy lifting.

Keep in mind that if you're running Windows Server or some other server software, you may already have all the VPN software you need as part of the server package you purchased. All you need to do is install, configure, and deploy it. It's normally excellent software, and it's been tested in the field for years. You've already paid for it, so why not get some use out of it?

There are also some excellent open-source VPN tools. These can serve you well, especially if you have on staff (or can contract) an IT person to install and configure them. However, support options can vary from decent to nonexistent.

Level The Playing Field

VPN software is yet another example of complex technology that's trickled down to small business, allowing those small businesses to derive from that technology some of the same benefits enjoyed by the big boys. Time for you to step out onto that—now much more level—playing field.

Network Attached Storage

Common Questions

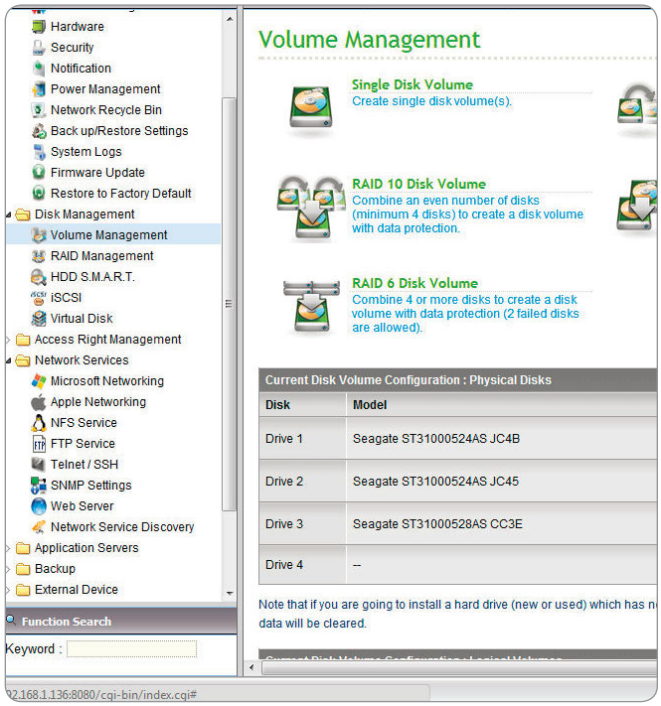
At a basic level, NAS devices function as miniature servers where you can store files that everyone needs to access.

When we think of storage, we normally envision a hard drive inside a computer, holding the operating system, applications, and all of the files used by that computer. Although it's possible to share files from a computer's hard drive, the process requires the PC to be on and connected to the LAN (local area network) with file-sharing features enabled. Many PC users don't want to leave their systems on all the time or risk security issues by allowing access to other network users. One solution? NAS, or network-attached storage.

Q: What exactly is a NAS? Is using one very complicated?

A: There's nothing all that complicated about setting up and using a NAS. A NAS device is a specially-designed appliance that groups one or more disk drives together and connects them directly to an existing LAN, using an ordinary Ethernet connection. Setting up a NAS device typically involves little more than filling it with hard drives (the same types of internal hard drives you would use in a computer) and attaching an Ethernet cable, which runs to a port on your router. Once installed, the NAS can be configured using the software included with the unit. Each PC user can then access the NAS. Modern SOHO (small and home office) NAS units make the setup process almost automatic.

NAS systems are built with the same type of hard drives you'll find in a PC.



The software included with the NAS will provide you with a utility to manage access and to determine how files are stored.

Q: Why bother putting storage on the network? Is it better than direct-attached storage?

A: NAS devices provide one place to share data, so that anyone on the network can efficiently transfer files to or from the shared storage. Since a NAS is optimized as a file server, network users will typically get better access performance from a NAS than they would by simply attempting to share files from the hard drives in an ordinary PC (which is not optimized as a file server). In addition, the NAS consumes a lot less power than a full computer, so you can leave the NAS running on the network constantly, so users can access data anytime—not just when someone's PC is on.

Data security is something that you need to think about when setting up the NAS. You'll need to add the NAS network share to each PC that needs access to the NAS. If there are PC users who don't need access, don't add the network share to their PCs. (The result will be that they won't even see the NAS in windows and dialog boxes that display their internal and network drives.)

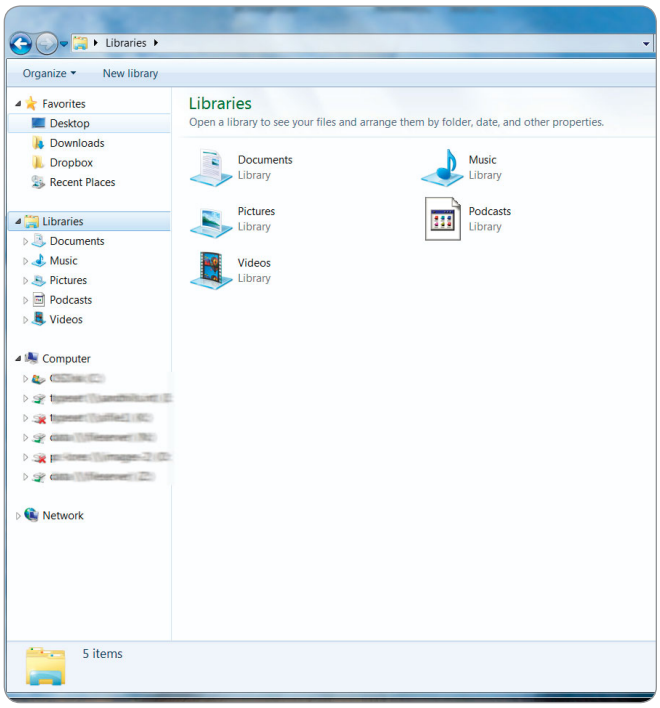
When you do install the network share on a user's PC, she will need to log in with a user name and password to access the NAS. In addition, the NAS can usually be configured with permissions for various combinations of network users and NAS folders, so you can authorize certain users to have access to different files and folders than other users. Beyond that, users may be given either read/write or read-only permission for files. The control can be quite granular, so it all depends on how you (or the network administrator) set up the NAS.

As you might imagine, tightening access controls takes more time and effort on the part of the network administrator, but it's a worthwhile investment when access to sensitive data must be restricted.

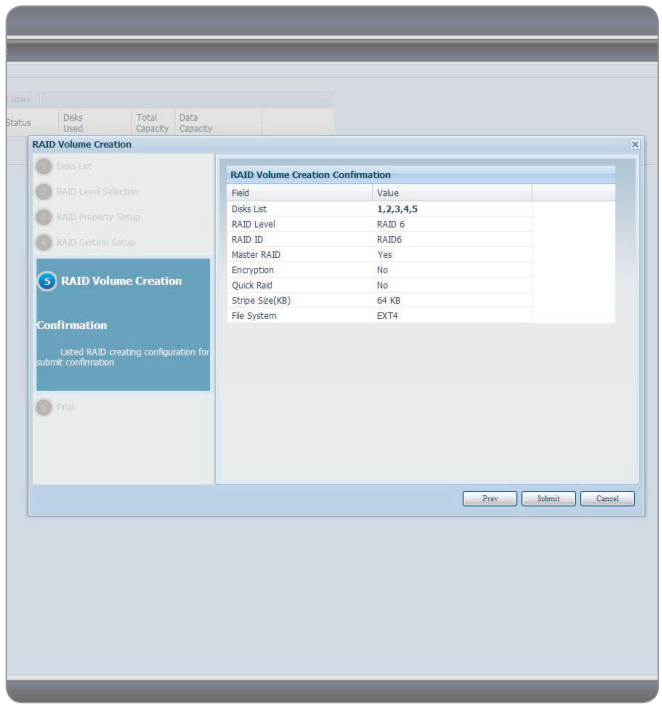
Q: What types of data can you store on a NAS? Can you run applications?

A: You can store any kind of data on a NAS. Home users can store family photos, music files, vacation videos, or backups of other important data such as electronic tax returns and so on. Small business users may use a NAS to store customer databases, document and email archives, PowerPoint presentations, and graphics and other business artwork.

Theoretically, you can install and run applications from a NAS, but application performance can become a serious problem, thanks to bandwidth issues and other obstructions. Remember that a PC will need to load the program from a NAS device



A NAS device provides an excellent way to back up the files stored in your Windows Libraries.



RAID configurations allow you to duplicate data so it will still be available if one hard drive crashes.

across an Ethernet network. Many users may be accessing the network at any given moment. Network contention may thus cause the major delays.

The general rule is to install applications on each individual user's PC, and then let the users store their data on the NAS. For example, you would install Microsoft Office on each PC, but store documents created in Office on the NAS so that the data can easily be shared. It's not much different than a PC with two hard drives: A user of such a PC could install the operating system and applications on the C: drive and then store data on the D: drive.

Q: What kind of drives does a NAS use? Can I add or change drives over time?

A: NAS systems use the same types of drives that appear in your PC. Most newer systems will use SATA (Serial Advanced Technology Attachment) drives. It's important to review the maximum allowable drive specs for any NAS that you're planning to purchase. A NAS device often ships without hard drives. However, it's not necessary to fill every drive bay in the unit right away. Many NAS systems connect drives via hot-swappable trays, so you can easily add more drives later without powering down the NAS.

Q: How much storage capacity can a NAS offer? How does RAID (redundant array of independent disks) affect storage capacity?

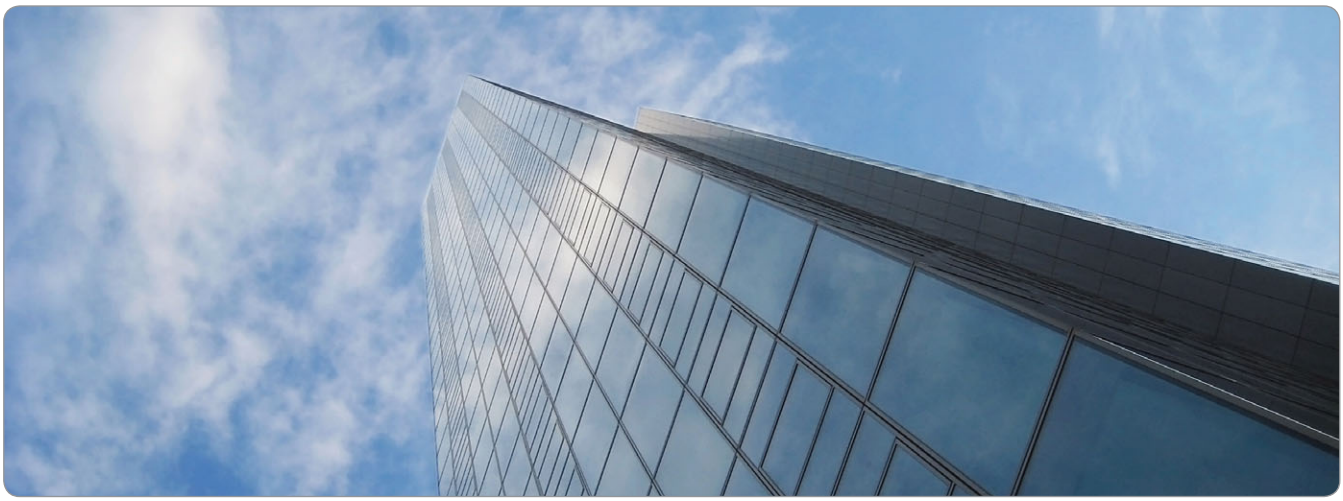
A: The total storage capacity of a NAS depends on the number of drives that a unit can hold, multiplied by the maximum size of each drive. For example, a NAS that holds up to eight SATA hard drives, where each drive can be 3TB (terabytes), could yield up to 24TB of storage.

Keep in mind, though, that you may want to use some of that storage capacity to protect your data. If you use a NAS simply as JBOD (Just a Bunch Of Disks), a disk failure would result in the loss of any data on that drive. Most NAS systems include support for RAID, technology that groups disks together to provide some level of redundancy, which helps prevent data loss. RAID is very effective, but will reduce the total available space on the NAS.

For example, RAID 1, also known as *mirroring*, is a configuration in which the contents of one disk are replicated to another disk. This is simple, but cuts your total storage in half. Let's say that we built the unit with 24TB of storage and installed RAID 1. You'll now have 12TB of effective storage for users (four disks at 3TB each, with another four disks at 3TB that mirror that content). A NAS with a RAID is ideal for businesses that need to ensure that the data stored on your NAS is always available, even in the event that one or more of the RAID drives fails.

Sky's The Limit

Doing Business in The Cloud



Don't make the mistake of thinking that "the cloud" is only for large companies; these days, even small businesses are heading for the cloud. In fact, if you're using Office 365, Google Docs, or other Web-based services, you're *already* relying on the cloud.

But let's start by defining some terms. What is "the cloud," exactly? Different people and companies define it differently. For our purposes, and to keep things relevant even to your (possibly very small) business, let's define it this way: The cloud is an amorphous group of servers whose size, type, and location may in fact be unknown to you, and on which you either store data or from which you receive some sort of software service. (Hence a term you may have heard: SaaS—software as a service.) In fact, another way to think of cloud computing is as *utility-based computing*: In the cloud reside software services that you can purchase on a pay-as-you-go basis, spending only what you need to, and only as those services are required.

The fact that you may not know where these servers are, physically, and that you don't know on which server or servers your data resides, is a key to true cloud computing. You may not have any control over where the servers are: Your data could reside on just one server in one location, or various chunks of your data could reside on multiple servers all over the world. In fact, although some companies opt to pay extra in order to control where their data resides, true cloud computing is sometimes said to include the assumption that you neither know nor care where your data lives; your cloud provider will, in fact, stash data all over the world, depending on where the provider can get the best rates. In theory, you shouldn't care about that, because when you access the data, the location of the data is transparent to you. All you care about is that it's there when you need it.

And therein lies at least part of the rub. Your data—or in some cases, the cloud-based software you use—is not under your control. It lives somewhere else and is controlled by some other company; if it goes down (and it will, sometime), there's not much you can do about it. Although your provider will certainly do its best to serve you, it does not care about your business as much as you do. It can't. After all, it has to care about its own business first.

Why The Cloud?

Still, there are excellent reasons to move to the cloud. And while analysts such as James Alexander, a senior vice president at Info-Tech Research Group, point out that in the long run you may not end up saving money, you *can* often save a great deal in up-front costs, in the same way that one might lease a car to reduce one's initial capital investment.

The important thing, notes Alexander, "is to identify the real reason you're considering going to the cloud. Maybe you have only one IT guy and, rather than have him spend time managing *things*, you want him to focus more strategic pursuits. Or maybe you like the fact that the cloud lets you be more mobile."

Cloud Considerations

If you're considering the cloud, Alexander says that there are five important points to keep in mind:

Security and compliance. With some industries, cloud computing may not make sense because of regulatory issues. Maintaining a compliant set of medical or financial records is different than keeping sales records, especially if you don't know where the records are housed.

Availability and reliability. Vendors promise (and usually deliver) excellent uptime, but it's never 100%. And if you're a small Internet-based retailer and your two days of downtime occur just before Christmas, well, that can have an impact.

Integration. Consider how well your cloud service integrates with the data and applications on your internal servers. The less integration you require, the easier your move to the cloud.

Network reliability. If your internal network isn't reliable, don't forget that you'll still be accessing your cloud services through that same network. If you need to increase bandwidth to improve reliability, that may be an unexpected cost.

Relationship management. Small business owners tend to sign contracts with lots of fine print and then just hope for the best. You need to be willing to take the contract out of the drawer and ensure that the vendor adheres to the agreed-upon terms.

It's Your Business, After All

Again, analysts such as Alexander say that, long term, working in the cloud is not really cheaper. "Going to the cloud to save money is like going to the casino for the free drinks," he says. In the end, vendors—like casinos—need to make money. One way or another, you'll pay for the services you require. Still, cloud computing is a good way to reduce up-front costs while taking advantage of the mobility, additional resources, and scaling that it offers.

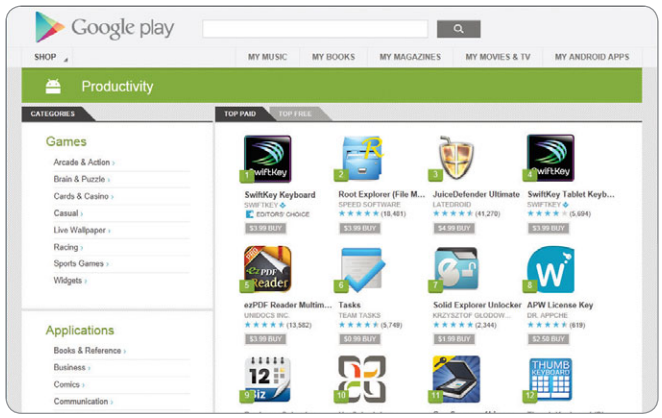
Utility-based computing allows you to offload some infrastructure, but in the end, it's still your responsibility. "Watch out for cost-creep," says Alexander. "It's like your cell phone bill. You have to be vigilant and ensure that you're not paying for more seats than you need, and that you're getting what you're paying for."

Alexander's final advice for small businesses? "Although by going to the cloud you can outsource the tasks, you can never outsource the responsibility."

Building Your Business

Choose An App Or Accessory Ecosystem For Your Products

The Microsoft software ecosystem encompasses X86 desktop software, as well as mobile software used on smartphones and tablets.



Google Play has the most users, but the wide variety of devices that can download and use your app may complicate your development.

For businesses that manufacture or design hardware or software products, few decisions have more impact on your success or failure than the ecosystem you choose. Whether it's a mobile app or desktop software you've developed, a smartphone accessory, or a line of snarky T-shirts you've designed, the ecosystem you choose will determine how your target market discovers, learns about, and ultimately buys your offering. Choose poorly, and you can kiss your profits goodbye; what's worse, you may never know whether the failure was due to the product or to how it was marketed. Choose wisely, on the other hand, and yours could be the next billion dollar IPO.

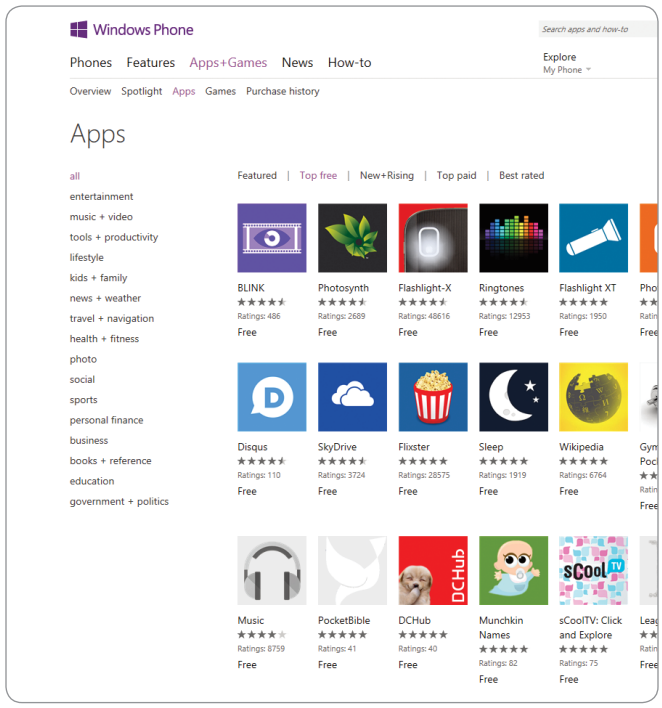
Not Too Big, Not Too Small

If the product you're peddling is fairly specialized, then you need to work a little harder at finding your audience. Where do the buyers of specialized products such as yours go to buy? Are your customers all relatively similar or do age, gender, income, and education vary widely? If there are several commonalities among your target audience, you can safely select a more targeted ecosystem. For instance, if you sell image-processing software for Mac-based operating systems, then you'll want to get your product listed in the Apple Store. Ideally, this sort of planning should be taking place well before you have a product ready to sell, but that's not always possible.

If your product's target user is less specialized, then you can effectively use multiple ecosystems, from Web-based to brick-and-mortar retail. But here too, you'll need to find ways to generate buzz. Undeniably, the Web is the biggest ecosystem available to businesses of all sizes, and the barrier to entry is relatively low. But because it's so large and so crowded, people actually need digital tour guides, or search engines, to help them find the information they're seeking. If you want to sell your product in the biggest pond around, make waves using SEO (search engine optimization).

If you want to sell your product in the biggest pond around, make waves using SEO (search engine optimization).

Apple's App Store is one of the largest app ecosystems you'll find, but getting exposure may be difficult.



The Windows Phone app store is the smallest of the big three, but it's growing quickly.

Cost Hurdles

Depending on the ecosystem you choose, you may need to pay a recurring fee to have your product listed in the digital marketplace or stocked on the shelves. Some ecosystems even charge a percentage of the final sale price, which will definitely eat into your profits. Software developers, especially app developers, have quite a range of ecosystem choices they can make, choosing among Apple, Google, Windows Phone, and more. Google Android is thought to have the lowest cost of entry, but that means your app has more competition there, and getting noticed may be more difficult. Apple and Microsoft's respective platforms each have a higher cost of entry, but the former provides a wider audience of users and the latter can let you easily transition your mobile app into one that works on Windows 8-based desktops and notebooks.

Open, Closed, Or Hybrid

Closed development environments, like Apple's, means that apps developed for the App Store will *only* work on Apple-made hardware. The upside here is that you know every user who downloads your app will be getting an identical experience, device generation notwithstanding. Apple does charge higher fees than other smartphone OS makers, and you'll be forced to use Apple's in-app billing system, which may conflict with your plans.

An app on Google Play will run on devices from a variety of device manufacturers, with varying screen resolutions, wireless capabilities, cameras, processing power, and more. Developing your app when so many variables are at play can be complicated and may leave some users with a less-than-satisfactory experience. On the positive side, developing apps for Android-based devices is considered fairly transparent, and the audience of Android smartphone users is the largest out there. (Android also supports the second-largest tablet audience.)

Windows Phone is the relative newcomer, and it operates within a hybrid environment: While Nokia manufactures Microsoft's flagship phones, other manufacturers also offer Windows Phones. Microsoft's platform also covers PCs running Windows 8, so there's a potential to reach a massive audience that goes beyond just mobile. Microsoft also has a fairly robust developer community in place to assist those new to the platform.

Ecosystem Roulette

For most small businesses, there's no reason you need to bet the future of the company on any one ecosystem. Many organizations may choose a platform on which to launch their product and then iterate based on feedback, moving to other ecosystems as the user base expands. Now all you have to do is develop the next big thing we just can't live without.

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All About Bluetooth

The Do-It-All Wireless Protocol

This logo is your is your first clue that the device you're holding offers more wireless capabilities than just Wi-Fi.

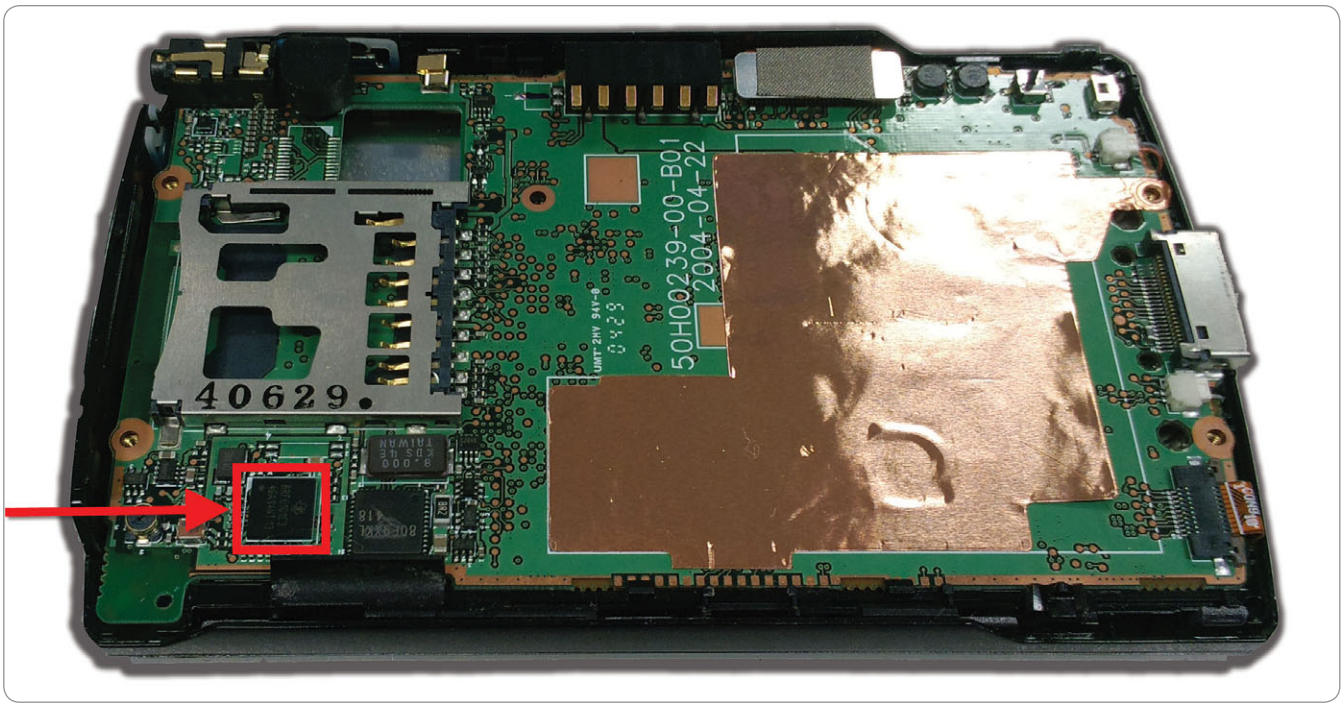
Bluetooth has been a popular short-range, low-power wireless standard for more than a decade now, but the technology seems to be just coming of age rather than growing long in the tooth. Chances are you currently own a Bluetooth-capable device. But there is a very high likelihood that your next smartphone, tablet, PC, notebook, car—and maybe even your next pair of running shoes—will have Bluetooth built in. ABI Research says that 2 billion Bluetooth-enabled products shipped worldwide in 2012 alone. According to the Bluetooth SIG (special interest group), in 2017 there may be as many as 20 billion cumulative Bluetooth-enabled devices shipped.

How It Works

Bluetooth technology uses radio waves in the 2.4GHz frequency spectrum to transmit voice, music, photos, video, and other data between Bluetooth-enabled devices. Like any standard that's been around for a while, Bluetooth has undergone several revisions. Depending on the device class, Bluetooth can communicate at a range of up to 3 feet (Class 3), 33 feet (Class 2), and 328 feet (Class 1); and at a rate of up to 3MBps (Megabits per second) and up to 24MBps using Bluetooth high speed. Like Wi-Fi, Bluetooth is capable of transmitting and receiving data through walls and solid objects, but it can do so using only a fraction of Wi-Fi's power.

Ease of use is one of Bluetooth's biggest benefits. Users can connect and share data by simply *pairing* two Bluetooth-enabled devices. Pairing consists of enabling Bluetooth functionality in each device and configuring them to recognize each other. After a quick device-specific confirmation, the two devices can begin sharing data, audio/video streams, and more.

There is a very high likelihood that your next smartphone, tablet, PC, notebook, car—and maybe even your next pair of running shoes—will have Bluetooth built-in.



Even devices that support the latest revisions of Bluetooth can still swap files with legacy devices, like this one. The small integrated circuit on the left is this PDA's Bluetooth chip.

Bluetooth Flavors

Bluetooth is popping up in a wide range of consumer electronics for a number of different applications, some of which may surprise you. It's a low-range specification that uses an energy-efficient means of transmission for small-sized data transfers. It's also capable of handling data transmissions at similar speeds as the latest Wi-Fi standards. It can stream audio, perform one-off file transfers, and act as a simple and secure device-pairing protocol before handing off the data transmission heavy lifting to another protocol entirely. But with so many applications, it's hard to nail the protocol down.

The Bluetooth devices you'll find for sale these days will fall into one of five Bluetooth specifications. Devices that support Bluetooth v1.2 are typically considered legacy devices. They're backward compatible with previous versions of the protocol and support the ability to perform error correction with voice transmission, with some increased latency. Devices that support this version of Bluetooth are most commonly used for simple file transfers and voice.

The Bluetooth v2.0 + EDR (enhanced data rate) core specification allows enabled devices to transfer data at up to 3Mbps and save power by operating in a reduced-power mode. Thanks to secure simple pairing (SSP), this revision also enables users to more easily pair devices. These devices tend to support stereo audio streaming, thus adding to the list of Bluetooth's capabilities.

Bluetooth v3.0 + HS became part of the core specification in 2009, and boosted the maximum potential data rates to up to 24Mbps. Bluetooth v3.0 + HS manages this eight-fold increase in throughput by handling only the negotiation and link establishment between the two communicating devices. Once the link is open, the 802.11 Wi-Fi radios transmit and receive the bulk of the transmission. Because this portion of the protocol requires Wi-Fi, it is not mandatory for all Bluetooth 3.0 devices. If this high-speed AMP (Alternate Mac/PHY) feature is something you want to take advantage of, both devices must support the "+ HS" portion of the revision.

The latest revision, Bluetooth v4.0, encompasses Classic Bluetooth, Bluetooth high-speed and Bluetooth low-energy (BLE) protocols. Bluetooth low-energy is based on Nokia's former Wibree low-power wireless technology. As the name implies, the technology is designed for extremely low power applications and devices that can go weeks, months, and up to and beyond a year between recharges or battery replacement. Devices, called Bluetooth Smart devices, include wearable gadgets, such as watches, pedometers, and heart-rate monitors; sensors used in healthcare, automotive, gaming, and sports; home entertainment

You can inexpensively add Bluetooth to your PC or notebook using one of these diminutive USB adapters.

Bluetooth headsets such as this one can use the A2DP (Advanced Audio Distribution Profile) to transmit one-way stereo audio.

equipment and remotes; wireless keyboards and mice; toys that can sense the presence of other toys; and more. The wireless communication standard is expected to work in devices powered by diminutive button cell batteries, so virtually any low-power device that could benefit from wireless communication is a potential candidate.

Bluetooth Profiles

To simplify all of these capabilities, The Bluetooth SIG created a handful of profiles, each with its own icon, to help you determine what the device can do.

Devices that carry the Headset icon, for instance, can use Bluetooth to transmit audio and voice signals between headphones, audio sources, headsets, and mobile devices. Many Bluetooth headsets also feature echo- and noise-canceling technologies to improve call quality.

The Human Interface Device Profile (HID) is responsible for how Bluetooth devices communicate with Bluetooth-capable keyboards, mice, and other input devices. Bluetooth-capable mice work without wires, whether you're at your desktop or on the road. The HID profile is also being used in devices that once typically used infrared, such as TV and stereo remote controls.

Bluetooth-capable devices that support the Music profile can wirelessly stream music from an audio source to a wireless stereo headset, car stereo, or Bluetooth speaker system. The Advanced Audio Distribution Profile (A2DP) defines how a multi-channel audio source is streamed over via Bluetooth.

The Basic Printing Profile (BPP) governs how Bluetooth devices send text, emails, vCards (electronic business cards), images, and other documents to printers. The Fax Profile (FAX) can also be used to wirelessly send faxes between compatible devices and fax-capable printers.

Two profiles commonly used for file exchange are Object Exchange (OBEX) and Generic Object Exchange Profile (GOEP). Both profiles let compatible devices swap pictures, documents, business cards, and other files over a Bluetooth connection.

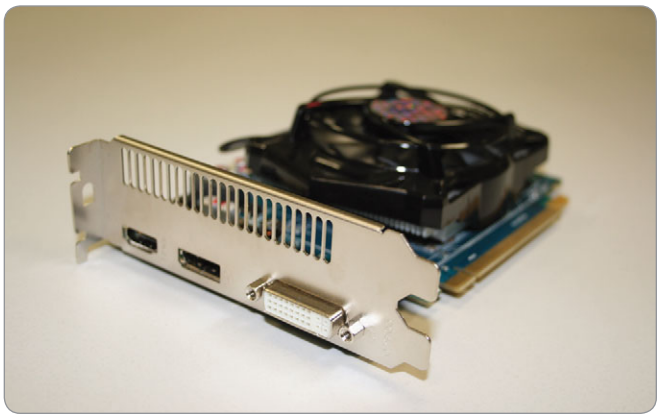
Bluetooth-capable devices that employ the Video Distribution Profile (VDP) can stream videos. Another profile that falls under the Transfer icon umbrella is the Dial-up Networking Profile (DUN), which defines how devices can access the Internet and other dial-up services via Bluetooth.

Many Ways To Do Wireless

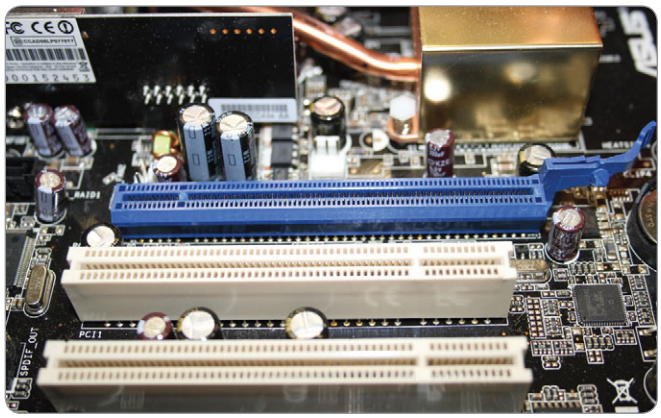
Bluetooth is capable of being alternately low-power, high-speed, medium-range, short-range, HD, and more. In fact, it's so flexible that some have called it the Swiss army knife of wireless protocols.

How To Install

A Graphics Card



This double-slot graphics card supports monitors with DVI, DisplayPort, and HDMI inputs.



The blue PCI-Express slot shown here has a locking tab on the far right that keeps the graphics card in place.

Compared to other computer components, the world of video cards changes quickly. What was top-of-the-line last year is middle-of-the-pack now, and high-performers from two years ago may not even be available. Thus, if you want to get the most from sophisticated software such as games or photo/video-editing programs, you'll probably need to replace your desktop computer's video card during the PC's lifespan. We'll show you how to pick a suitable video card for your PC and explain how to install it.

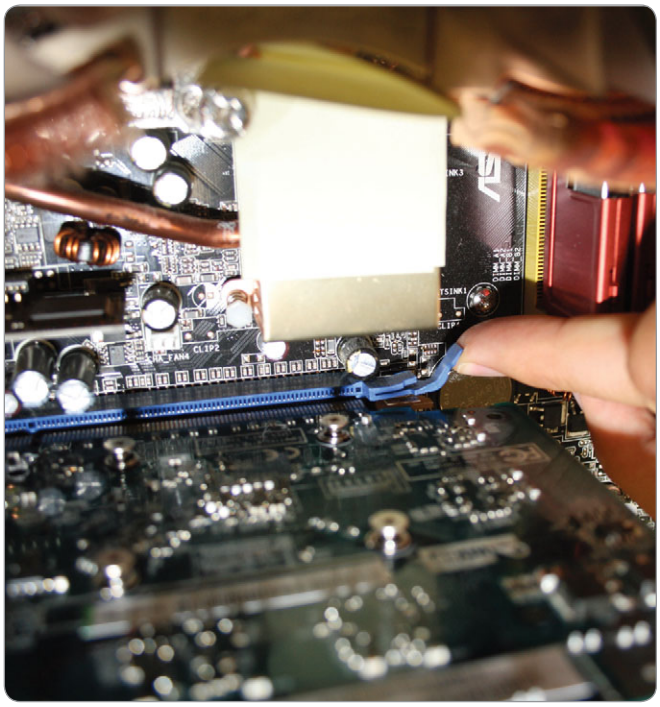
Find The Right Graphics Card

Most PCs manufactured in the last five years use PCI-E slots for discrete graphics cards, but older PCs may only feature AGP (Accelerated Graphics Port) or PCI slots. Once you determine which interface your computer's motherboard uses, you can shop for a graphics card that utilizes that interface.

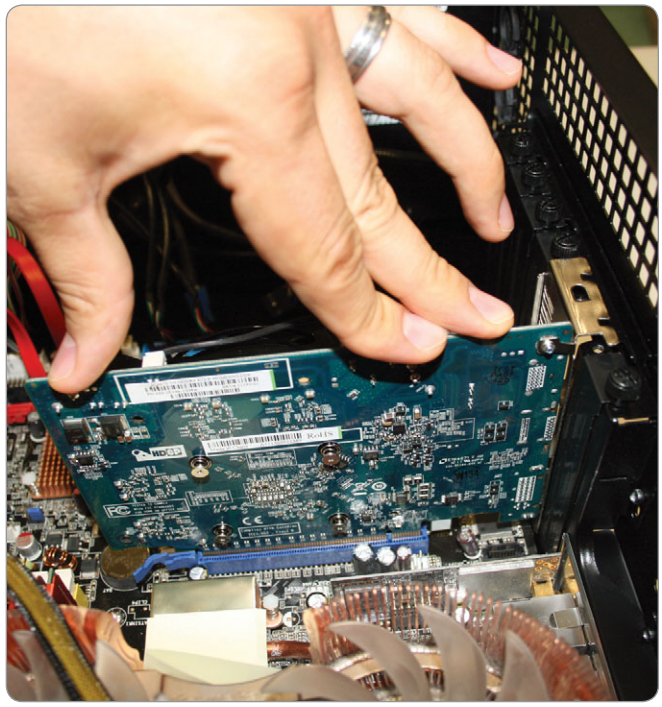
Also note the display outputs. Most current graphics cards have one or more long rectangular DVI (Digital Visual Interface) ports, typically white, that transmit uncompressed digital video signals to your monitor. The blue port is called VGA (Video Graphics Array) or D-sub, and it transmits analog video signals to your monitor. Many modern graphics cards have DisplayPort and HDMI (High-Definition Multimedia Interface) ports. Make sure the graphics card you select has an interface that your current monitor supports.

Mid- and high-end graphics cards typically require supplementary power from the power supply, usually in the form of one or more

Many modern graphics cards have DisplayPort and HDMI (High-Definition Multimedia Interface) ports. Make sure the graphics card you select has an interface that your current monitor supports.



Don't remove the old graphics card without undoing the locking mechanism on the PCI-E or AGP slot.



Line up the card's connectors with the motherboard slot and press down to seat it properly.

6-pin or 8-pin PCI-E power connectors. Make sure your power supply has the appropriate number of unused power connectors. If you have to resort to power adapters, your graphics card might not be powerful enough to handle the added strain.

Finally, make sure the graphics card you buy will fit in your case; low-profile cases require low-profile cards. Many graphics cards are also double-slot, meaning they take up two expansion slots on the motherboard. Most high-end graphics cards are longer and typically won't fit in mid-tower and smaller cases.

How To Install The Graphics Card

Once you've selected your new graphics card, installing it yourself is relatively painless. Simply follow these instructions in order, and you'll be pleasing your peepers in no time.

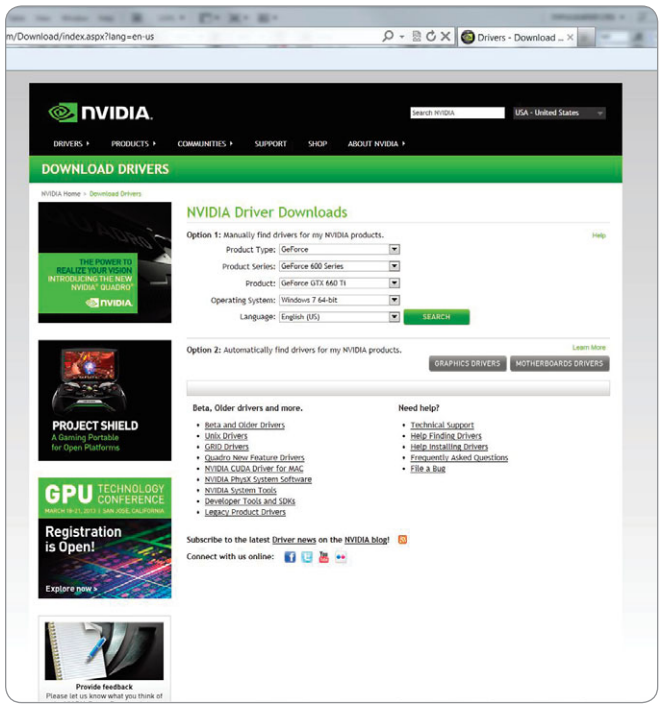
Uninstall drivers. The first step is to uninstall the existing graphics driver. To do this in Window 7, start by clicking Start, Control Panel (in Category view), and then click Uninstall A Program from the Programs category. If you run Windows 8, right-click the bottom left corner and select Control Panel. Then, select Uninstall A Program from the Programs category.

If you see listed tools associated with your old card, click the item(s), click Change or Uninstall/Change from the top of the window, and then follow the instructions. When removal is complete, the system will restart. Next, you'll want to shut the system down completely. Turn off the power supply where the power cable attaches to the PC, and remove the case's side panel. Make sure to touch the metal portion of the case frame to dissipate any static electricity, and unplug the power cord from

Disable Integrated Graphics

If your PC currently doesn't have a graphics card, you may need to disable the integrated graphics chip on the motherboard before you install a card. Restart the computer and watch the splash screen to see which key you'll need to press to bring up the BIOS (Basic Input/Output System), which is an area where you can make changes to the key hardware on your PC. Once the BIOS is open, find the section, such as Video or System Settings, where you can either disable the integrated video or force the PC to use an add-in video card.

Once installed, just connect your monitor to the appropriate port and then feast your eyes.



It's best to download the newest drivers from the card manufacturer's website.

the power supply. Also remove the monitor cable, audio cables, USB cables, and any other peripherals attached to the PC.

Out with the old. With your PC shut down and disconnected from the main power, you can now go about the task of removing your old graphics card. (What? There is no graphics card? See the "Disable Integrated Graphics" sidebar on the previous page.) Typically, the graphics card will occupy the topmost area of the motherboard's expansion slots. If your monitor plugged directly into the motherboard, then chances are you were running integrated graphics and have nothing to remove. If the monitor cable was connected to an expansion card, then this is most likely your existing graphics card; remove the screw(s) holding the bracket to the rear of the case, disconnect the one or two auxiliary power connector(s) from the old graphics card, if there are any, unlatch the PCI-E (or AGP, as the case may be) slot's locking mechanism, and then gently lift the card straight out of the slot.

In with the new. If necessary, use a can of compressed air to ensure that the graphics slot is clear of dust, and then carefully slide your new graphics card into the topmost available graphics slot. Secure it with one or two screws and connect any auxiliary power connectors as necessary. Replace and secure the PC case panel, and connect the power cord to your computer and to the main power. Reconnect your peripherals, and ensure that your monitor cable is connected to the appropriate port on the back panel of the new graphics card. Next, turn the PC back on.

Install the new driver. While any graphics card you buy at retail is going to ship with a driver disc, we recommend downloading the latest graphics drivers from the manufacturer's website. You can find these on the support pages for whichever brand of graphics card you purchased. Look for a section labeled something similar to Support, Downloads, or Drivers. Once the file has downloaded, run it and follow the on-screen instructions. Note that your monitor may go dark momentarily (so don't panic if that happens), and you may need to restart your PC when the installation has completed.

All Systems Go

To make sure the new graphics card is pulling its weight, right-click anywhere on the Desktop. You should see a menu that includes an item with the name of your new card. If so, then your new graphics card and driver are functioning properly. Select the appropriate option from that menu to tweak your graphics card, adjust resolution, change multi-monitor settings, and more.

Password Managers

Put A Padlock On Your Online Identity

Sit up straight, wash behind your ears, eat your vegetables, look both ways before crossing the street, and always use strong passwords. OK, so Mom probably didn't mention that last one, but she should've. Passwords keep your identity and money safe when you're online, so it makes a lot of sense to make sure those strings of characters are built like Fort Knox. Password managers are the key to making the most of your online security.

What Password Managers Can Do For You

A password manager is typically a lightweight software application that saves the logon details of your various user accounts and automatically logs you in as you access those secure services. Many include browser plug-ins, let you create secure passwords, automatically fill out forms, and do even more to help you keep your virtual and real identities out of the hands of cyber criminals. Password managers utilize a master password, which you must memorize and enter whenever you want to access your secure sites. Almost all password managers support multiple browsers, including Internet Explorer, Firefox, and Chrome; the ability to fill in shipping addresses, credit card numbers, and other fields; and category tags so that you can organize your secure sites and quickly launch them from the password manager interface. There are other

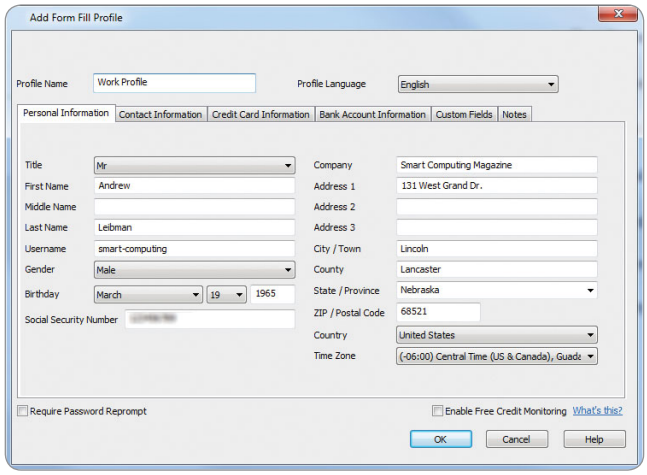
ways that cyber criminals can get your online usernames and passwords, but password managers can help thwart the vast majority of them.

Beat The Breaches

It seems like every month another high-profile security breach results in hackers making off with the credit card details, passwords, and financial data of millions of unwitting users. Recently, the popular social networking site LinkedIn announced the potential exposure of 8 million account holder passwords that were encoded but exposed. Hackers quickly got to work decoding them and managed to uncover many of them, even those that contained number/letter substitutions, a combination of capital and lowercase characters, punctuation, and uncommon words. In fact, many experts believe passwords that use these tricks are relatively easy for advanced password cracking software and hardware to solve.

The best passwords are truly random, and even those are better if they're longer, between 15 and 20 characters or more. Most password managers include built-in password generators, and because the password manager can remember the password for you, you won't need to.

Having created one strong password, now do it again for each and every service you use. One of the harsh realities we must face is that there's no such thing as a perfect password. All it takes to crack practically any password is a hacker with the right tools and some time. It's best to start by creating multiple strong passwords, a different one for every site or service you use. This ensures that even if your encrypted password gets exposed, the hackers will only have access to one aspect of your online identity, limiting the damage that can be done. Pass-



Password managers can fill out forms to make online shopping easier and safer.

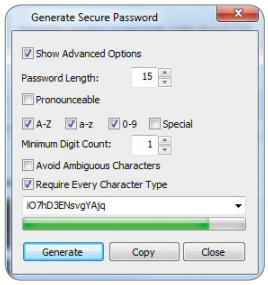
Password managers step in to input the username and password whenever you are asked to verify your online identity.

On-screen keyboards like this one can help thwart keylogging malware.

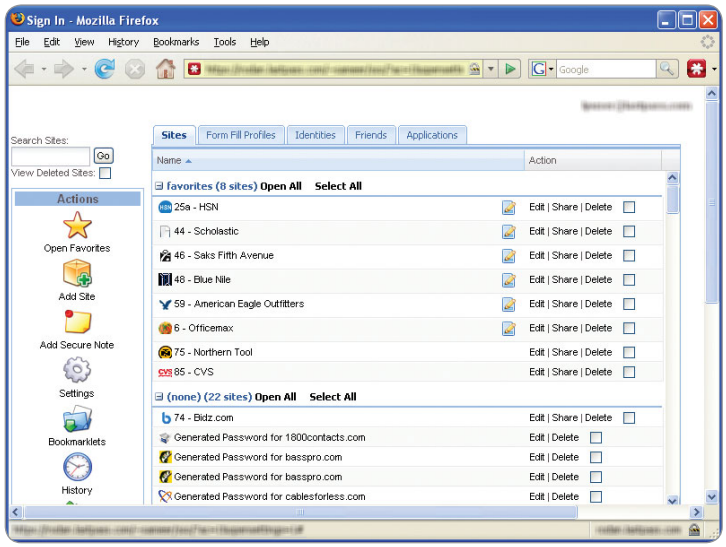
word managers can help you keep track of the dozen or more passwords you'll need to maintain. Again, with a password manager, the only password you'll actually need to remember is the master password.

Bonus Security Features

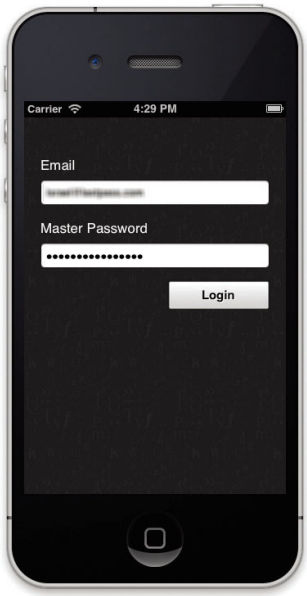
All password managers worth using automate the logon process for your online services and websites. Some offer a selection of security features that are not directly related to this core function, but are nice to have. One that we like is a virtual keyboard, which is a way to thwart keylogging malware. If you're the forgetful type, then look for a password manager that automatically reminds you to change your passwords. The forgetful among us should also look for a password manager that provides master password hints. (Some managers exclude this feature in an attempt to make the software more secure.) Most password managers support 256-bit AES encryption, so use this as a minimum requirement, especially if your passwords protect particularly sensitive data, such as business, medical, or financial records.



Password generators can help you create strong passwords for every site or service you use.



Password managers that sync online let you quickly access your secure logons no matter where you are.



Many password managers also work on your mobile devices.

If you want to use a password manager on a computer or device to which multiple people have access, then make sure you get one that automatically logs you out of the password manager after a period of inactivity or once a set interval has passed. If your password manager lacks this feature, then get into the habit of logging out of it when you're stepping away from the computer or device.

Because you don't just use desktops and notebooks to access the Web, look for robust mobile device support, including support for smartphones and tablets. If you have an Android phone and an iPad, for instance, make sure the software supports both platforms. Many will also run from a flash drive, so you can simply plug the drive into a USB port on a public computer to access your sites without leaving a trace on the computer. If you use a biometric device on your desktop or notebook, look for password managers that support biometric input.

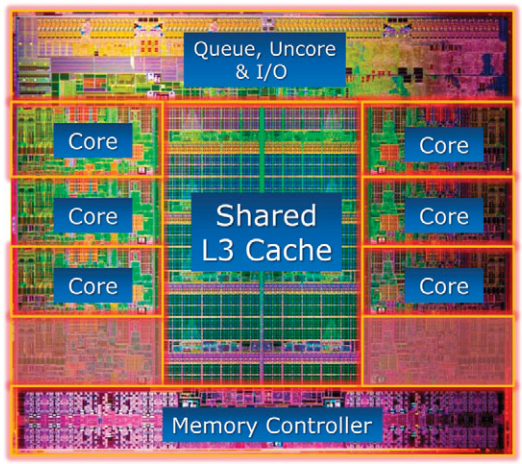
Choosing The Right Password Manager

To find the password manager that best suits your needs, compare features across multiple titles and develop your own list of the must-haves. Given the variety of password managers available, we think you'll have no trouble finding the right one.

CPU Caches

L1, L2, and L3 Cache Explained

Inside a CPU, such as this Core i7 from Intel, are two or three fast memory caches for data.



This diagram of an Intel Core i7-3970X shows its level 3 cache. Each core has its own L1 and L2 caches, too.

You may be familiar with the role of RAM (random access memory) in your computer. RAM gives the PC a fast place to store data it's currently using, such as the applications you're currently running and the documents you have open. If your PC's processor had to constantly read that information from your hard drive or SSD, your computer would be too slow to get anything done.

What you may not know is that inside the processor itself, there are tinier, even faster stages of RAM called *memory caches*. The caches temporarily store data that's ready to be processed, along with any recently used data the CPU thinks that it might need again and new data it's likely to require soon.

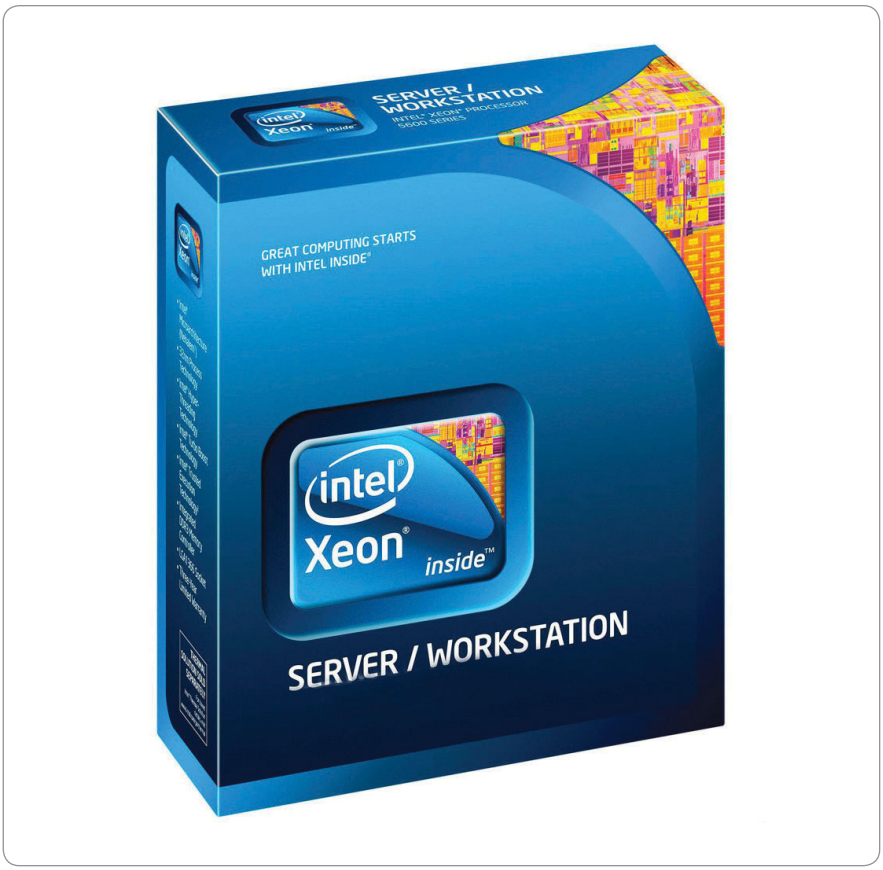
A typical CPU has two or three caches. These include the tiny, fast L1 (level 1) cache for data and instructions being used immediately, and the larger and slightly slower L2. In some cases, a chip will have a much bigger L3 cache that is slower than L2, but still much faster than the PC's RAM.

If the processor (or one of its cores) doesn't find the data it needs in its L1 cache, it checks the L2, the L3 (if present), the computer's RAM, and finally the hard drive or other storage devices.

Every processor core has its own L1 and L2 cache, so a quad-core chip would have four sets of L1/L2 cache memory, for example. Level 3 cache, on the other hand, is primarily used in multi-core CPUs as a single, common memory space that all the cores can share. L3 cache is sometimes called LLC (last level cache) or Intel Smart Cache in recent processors from that company.

A Tool In The Hand

Let's illustrate caches with a real-world example. Say you're out building a birdhouse in your backyard. There's a hammer in your hand, a few other tools in your toolbox, and more tools in your garage. You realize that one of the boards you're using is a little too long, so you head to the garage to fetch a saw. After you trim the board, however, you lay the saw near your toolbox—just in case you'll need it again before your project is finished.



Intel® Xeon® processors are heavy-duty workhorses aimed at the server market. The E7 family of CPUs, for instance, feature up to 10 multithreaded cores, caches of up to 30MB, and run at speeds of up to 2.40GHz.

In this analogy, the tool in your hand at a given moment, such as a hammer, is like the data stored in a CPU's L1 cache. The toolbox is the level 2 cache, and your garage is the L3.

Carrying the analogy a bit further, you can think of the RAM as a friendly neighbor who loans you tools you don't have, whereas the hard drive is the hardware store in town that sells you items your neighbor doesn't possess. If your CPU needs to read data from a CD, DVD, or the Internet, that's like having to order a new tool online and then wait for it to arrive, relatively speaking. (As it happens, to help speed things along, hard drives and optical drives have caches of their own, called *buffers*. Cache buffers hold recently read data as well as incoming data waiting to be written to the hard disk or optical disc.)

Cash For Cache

So what should you look for when it comes to the cache memory in your next processor? Well, we wouldn't exactly call level 1/2/3 cache a primary concern when you're shopping for a new CPU: Processors generally come with caches commensurate with their intended levels of performance—but here's some background on the ways that some caches are better than others.

First of all, the more levels of cache, the better. An inexpensive, value CPU may have only L1 and L2 caches; that's perfectly acceptable and more than enough for typical small business computing tasks. A mainstream or performance-oriented chip will probably have an L3 cache (of whatever catchy marketing name), as well. With the ability to cache a greater amount of data in speedy, temporary memory, the CPU with L3 cache will spend less time waiting for data from the RAM or storage drives.

The next thing to keep in mind is that a bigger cache is better than a smaller one. All else being equal, an 8MB L3 cache will give you more of a speed benefit than 3MB, for instance. (Not that all things are in fact often equal, so be sure to take into account other variables: memory, graphics processors, hard drive configuration, etc.)

Finally, the caches in newer generations of processors are probably superior to those in older CPUs, as newer lines of chips often have better cache performance. This may be due to higher frequencies, better data-sharing among the cores and other caches, speedier transistors, and other design changes.

Recommendations

In the end, you should buy a CPU that has the right power/price balance for your needs and your budget. Don't buy more than you need—or at least, try not to pay too much for the extra, (supposedly) unneeded power. Why the hedge? Well, the future has a way of arriving unannounced—and much sooner than expected. The CPU that was plenty powerful enough for what you were doing in your office-cum-den a while back might turn out to be woefully underpowered when your business takes off and you find yourself in a real office environment, creating documents and media of a size and complexity you hadn't anticipated six months earlier.

Of course, cache memory is just one factor among many when it comes to a chip's performance. But, if you have the option to buy an otherwise similar processor with more cache, we recommend that you do so.

Find It Online

Google Drive

www.drive.google.com

This popular mobile app also has an associated Web service with which you can connect via your PC. Google Drive combines the features of Google Docs with 5GB of free cloud storage, which you can use to back up key files, images, and videos. Google recently announced a Preview feature that will provide a visual display for up to 30 file types; flip though the files to quickly scan documents, watch videos, or flip through images. Supported file types include .JPEG, .MPEG4, .DOCX, .XLSX, .PPTX, .TIFF, and .PDF.

Instructables

www.instructables.com

If you're looking for a way to share an interesting project you've completed, or to get some ideas for creative things you can do at home, Instructables is a great place to start, as there are currently over 100,000 projects available. Instructables started in 2005 as an in-house documentation system for Squid Labs. It's now host to a huge community of people who share their creations. Popular channels at press time included Woodworking, Toys, Soups & Stews, Photography, and (our favorite) Pies. There's also a section called The Family Handyman and TechShop, where you'll find detailed how to's with photos and step-by-step guidelines for projects. You can communicate with the active community via a Forums area, where you can post questions and solicit advice.

MATTER

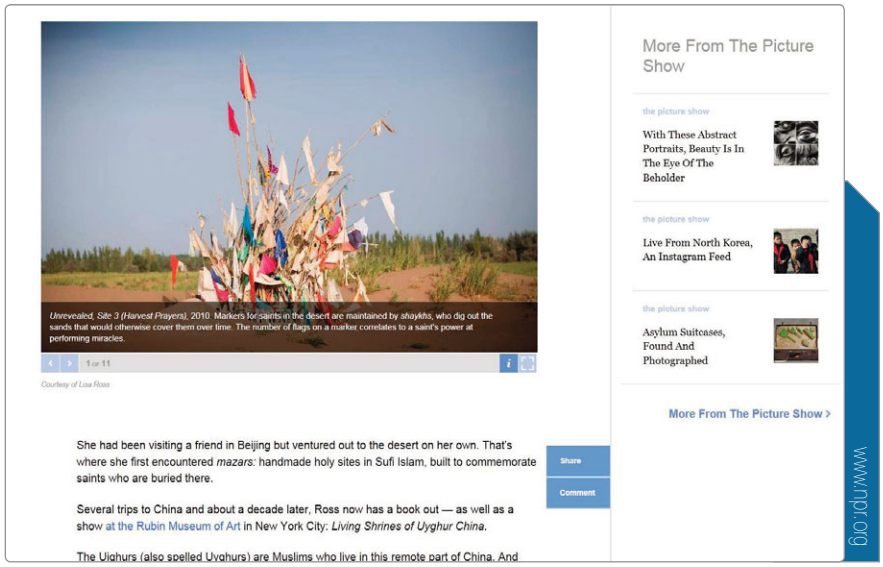
www.readmatter.com

Those interested in the fields of technology, medicine, the environment, and science—and who seek in-depth coverage—will want to visit MATTER. It's a digital source for long-form news and analysis that's sometimes tough to find on modern digital media. And the website can be read as easily on a PC as on a tablet, eReader, or smartphone. MATTER costs just 99 cents a month, and includes every article they publish during the month. Members will also receive eBook downloads (in the .MOBI and ePub formats), as well as audiobook versions, so you can listen to the story in your car or on a portable audio device. Even better, members can take part in an online question-and-answer session with the authors and editors, so you can find out more about a given story or get answers to important questions.

The Picture Show

www.npr.org/blogs/pictureshow/

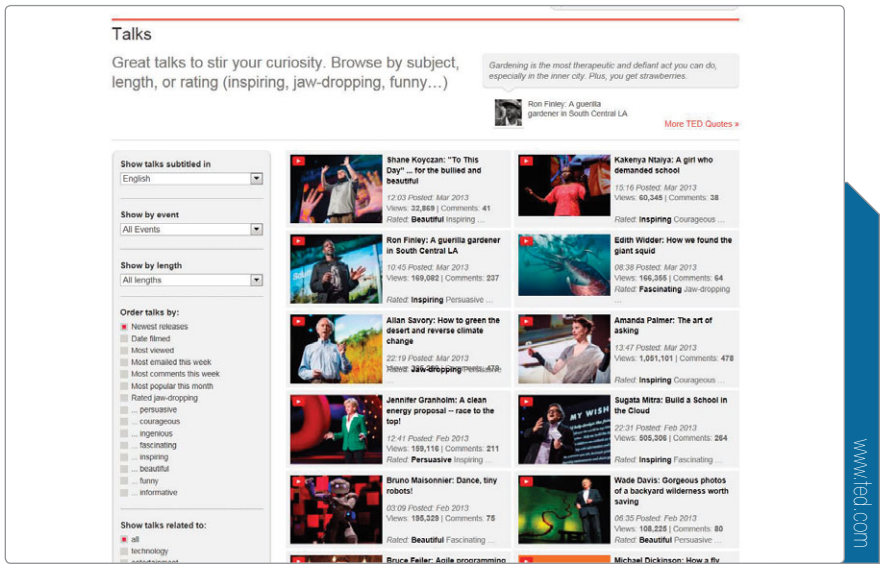
Fans of NPR should visit The Picture Show to discover more about the stories and see images go along with the daily NPR news. The photo stories are typically filled with images, so you'll be able to see a variety of photos that enhance each story. NPR also links you to other sources and images, so you can do more research.



TED

www.ted.com

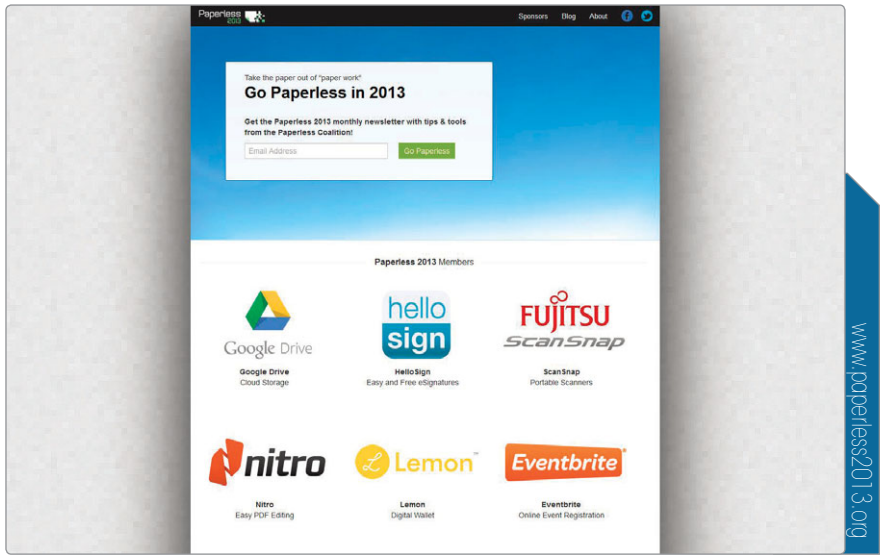
Short for Technology, Entertainment, and Design, TED is a nonprofit website that has devoted itself to what it calls "Ideas Worth Spreading." You may already be familiar with TED Talks, a series of live-streaming lectures and performances where known thinkers and doers are challenged to give the talk of their lives for 18 minutes or less, and TED.com provides access to more than 1,400 archived TED Talks. You'll easily be able to sort through the various TED Talks, as there are filters for the T.E.D categories, as well as Business, Space, Science, and Global Issues. There's also a search field at the top of the website, in which you can enter specific queries.



Paperless2013

www.paperless2013.org

This website is part of a campaign to "take the paper out of paper work." On the main page, you'll be able to sign up for a monthly newsletter that will provide you with tips and tools from the Paperless Coalition. You could print out the newsletter, but . . . well, just don't. You'll also find a variety of Web utilities that you can use to reduce the number of receipts, paper records, signatures, event documentation, and bill payment records that you'll need.



What You Need To Know

Headphones

1) On-ear headphones look similar to over-the-ear models, but they feature smaller ear cups.

2) Over-the-ear models are ideal as studio monitor headphones for professional audio environments.

Headphones are a useful accessory for many of today's devices, including laptops, smartphones, tablets, and portable media players. In some cases, headphones are the only way that you'll be able to hear audio from a portable device. Here, we'll examine the different types of headphones and what you need to consider when purchasing them.

Over-The-Ear

As the name suggests, over-the-ear models are designed with comfortable ear pads that surround your outer ears, so the headphones don't sit on your ear lobes. Also known as full-sized or circumaural, over-the-ear headphones create a natural seal by sitting against your head, which can help to reduce external noise that can be intrusive when you need to focus on the task at hand. Over-the-ear models are the largest style of headphones. The large size allows manufacturers to incorporate larger, high-end speakers into the ear pads for a superior sound, compared to other types of over-ear headphones. On the flip side, the large size makes over-the-ear headphones less desir-

OVER-THE-EAR MODELS

are the largest style of headphones. The large size allows manufacturers to incorporate larger, high-end speakers into the ear pads for a superior sound, compared to other types of over-ear headphones.

able for a traveler who has limited space for headphones in his travel bag.

On-Ear

This style of headphone is similar to over-the-ear, except that the ear pads sit directly on your ear lobes. You'll still enjoy the comfort of cushioned or foam ear pads, and the flat cups are typically smaller and lighter than over-the-ear models. The on-ear design still allows for some ambient noise, which is perfect if you plan on wearing the headphones while walking (allowing you to hear traffic and others around you) or if you want to keep an ear out for a phone call.

Behind-The-Neck

A band running behind the ear pads or earbuds rests against your neck, which is perfect for people who wish to listen to music while exercising. Thus, behind-the-neck headphones are ideal for runners, bikers, hikers, and other outdoor enthusiasts.

Clip-On

These headphones feature an attachment that slides over your ear, so it's easy to take on and off. The lightweight, easy-to-put-on design makes them appealing for people who are on the go and want a portable set of headphones they can easily slip on and still be able to hear ambient noise around them.

Earbuds

These are one of the most popular headphone options because the ultra-portable design allows them to be taken anywhere. You wear earbuds by resting them inside your ear, which naturally helps to block out background noise that may be distracting when you need to concentrate or just want some time alone with your thoughts. Earbuds are handy for commuters, travelers, and anyone who wants small, pocketable headphones.

3) Clip-on style headphones are great for anyone with an active lifestyle.

4) Earbuds feature a compact design that lets you take them wherever you go.

Buying Advice

- Consider the types of activities you perform while wearing headphones and invest in a style that best matches those activities.
- If it's important that you only hear audio from your computer or other mobile device, look for headphones that feature sound-isolating or noise-cancelling technology, which are two ways that headphones reduce ambient noise.
- Wireless models that communicate via Bluetooth are convenient for people who use headsets with laptops, smartphones, and other Bluetooth-enabled devices.

Five Things You Didn't Know About . . .

Smartphones

Even without access to a GPS signal, your smartphone can still tell others where you are.

Smartphones are undoubtedly on the fast track to ubiquity. But even though you probably have one on your desk, or in your pocket, purse, or backpack right now, there may be a few things about these powerful devices that you didn't know. In this article we'll highlight a handful of the most useful smartphone secrets.

Big Brother Is (Still) Watching

Most smartphones for sale today include GPS (global positioning system) integrated circuits, enabling your smartphone and a multitude of location-aware apps (not all of which are related to mapping) to pinpoint your location.

While this technology is an important part of what makes your smartphone so useful—helping you get directions, finding nearby businesses, and letting friends and family know where you are—it also has the potential to expose your whereabouts to people you don't intend.

Your smartphone's privacy peccadilloes aren't anything new, but what you may not know is that even with GPS turned off, your phone can still determine your location. It does this by various means, depending on how advanced your phone is and where you are. For instance, if you're on the road and a cloudy sky is keeping GPS satellites from locking in on you, your phone is capable of using nearby cellular towers to triangulate your position.

Assisted GPS is a term used to refer to the technology capable of using a combination of cell towers, GPS satellites, and even nearby Wi-Fi networks, to find your position. Even phones that don't come with GPS integrated circuits can still be found.

In order to keep your location a secret, you may need to manually disable location services from the phone's Settings menu and make sure that apps employing geolocation, including many social networking apps, are not reporting your whereabouts against your wishes.

Killing Processes May Do More Harm Than Good

If you've gotten into the habit of manually killing the apps that continuously run in the background on your smartphone, you may be punishing your device's battery life more than you think. Modern smartphone OSes, including Apple's iOS, Google's Android, Microsoft's Windows Phone, and others, are all optimized to keep your battery running as long as possible. Apps that run in the background on the latest versions of smartphone OSes are in a suspended state, and they consume very little power while maintaining this state. By killing the app, you aren't saving much power to begin with. Even worse, if the app

Performing a factory reset on your smartphone may not ensure that your device is scrubbed clean of personal data.

Cloud-based storage apps, like SkyDrive, can supplement your smartphone's internal storage capacity.

needs to sync settings with the Internet, determine your location, the current date and time, then it'll spin up one or more of the cellular, GPS, or Wi-Fi radios, stress the processor to determine your phone state, and dive into memory to gather all the data it needs. Multiply this by a few apps and you can see how forcing them to shut down when you're not using them can do more to drain your battery than just allowing the phone's OS to tuck them into the background when you're not actively using them.

Store More In The Cloud

When you bought your phone, chances are its internal storage was one of the factors that contributed to the price you paid. Consumer-based cloud storage services have exploded over the past few years, and there are several you can choose from to sync files between multiple smartphones, tablets, and PCs. With a cloud-based storage app on your smartphone, you can dramatically increase the amount of data you have at your fingertips. In this way, you can regularly swap files in and out of your cloud storage app's folders. As long as you have a cellular or Wi-Fi connection, these apps will let you open, view, edit, listen to, and watch just about any sort of file you use.

A Factory Reset Can't Prevent Data Theft

When it's time to upgrade to a new phone, you might think that performing a factory reset on the old unit is sufficient to keep cyber thieves and others with less-than-innocent motives from finding out where you live, uncovering online account passwords, and wreaking havoc on your social networks.

Not true. Just as when you delete a file on your computer, the data on your smartphone after a factory reset isn't gone, it has just had its placeholder (called a pointer) removed. Forensic experts can recover data on factory reset phones, and we'd bet good money that cybercriminals aren't far behind. On your PC, you can use a secure erase program to essentially overwrite the entire memory space with junk. Until we get smartphones that support similar secure-erase capabilities, your best bet is to donate your phone to a certified recycler that is audited to prove that it renders your data unrecoverable. Your only other alternative is to smash it, particularly the memory chips, to bits.

Overseas Calling

This one is important: Failing to heed this warning has cost people big bucks. Before you travel overseas, call your mobile carrier and inquire about signing up for a temporary international calling plan. This will cost you *much* less than using your normal plan. An even more affordable route might be to just purchase an inexpensive pay-as-you go phone when travelling abroad.

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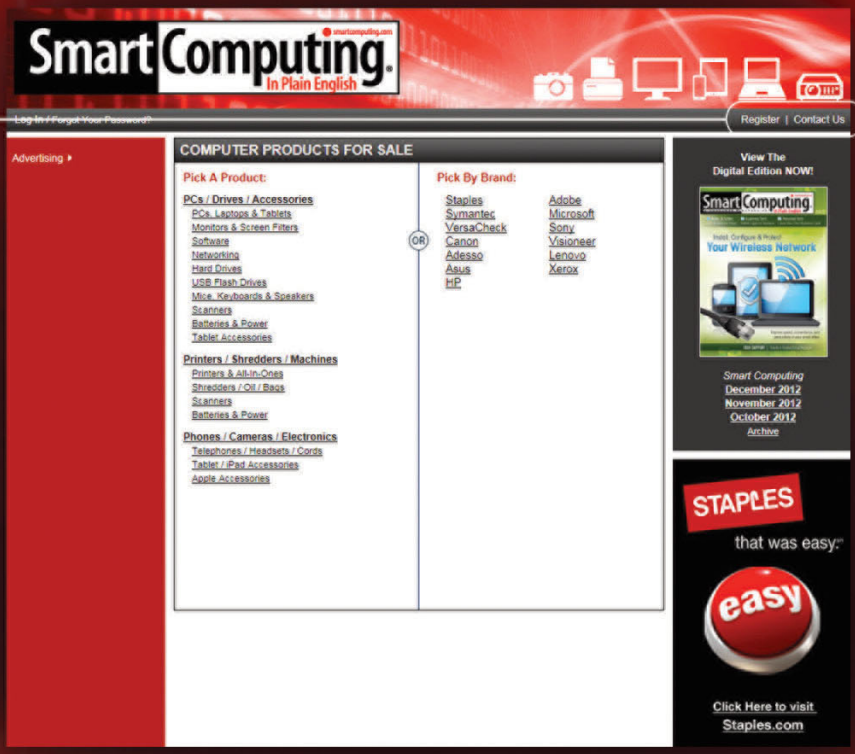

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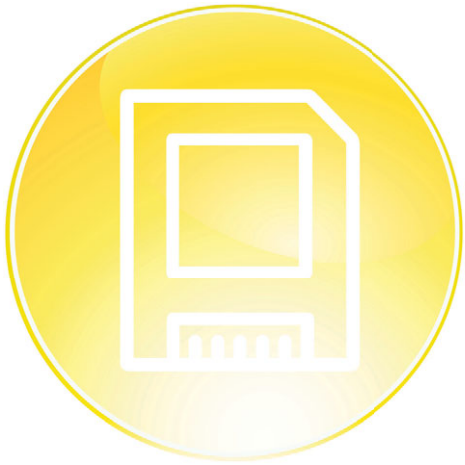
Troubleshooting Reference: MEMORY



Problems with your PC's memory, or RAM (Random Access Memory), can result in a variety of issues, including seemingly random freezes, crashes, and system errors. When you're seeing these types of issues, there are no obvious error messages that indicate something is wrong with the memory in your computer. Here, we'll show you how to discover if your RAM is the problem and give you some ways to fix it.

Is It A Memory Issue?

The most common manifestations of RAM problems are operating system crashes or applications that hang or won't respond. If you're experiencing these issues, try running an anti-virus scan with your security software just to be safe, because a virus can cause similar symptoms.

Memory Analysis

Windows 7 includes the Windows Memory Diagnostics Tool, which will help you detect problems with your computer's RAM;. To manually run the utility, click the Start button, select Control Panel, and type **memory** into the search box. Select Diagnose Your Computer's Memory Problems under Administrative Tools, and you'll see two options. You can choose to have Windows restart right now and check the memory, or you can tell it to wait until the next time you reboot your PC.

If the Windows Memory Diagnostic finds errors, you'll see a pop-up that tells you where the memory failed. In this case, you'll likely need to replace the memory to fix the problem. If the utility detects no errors, no message will be displayed and Windows will go ahead and load your Desktop.

Quick Fix

Nearly all PCs contain more than one memory module. It's possible that only one of the sticks of RAM is causing the problem, so try removing one and see if that fixes the issue. Continue switching out the memory until you find the memory stick that's causing the problem.

Prevention

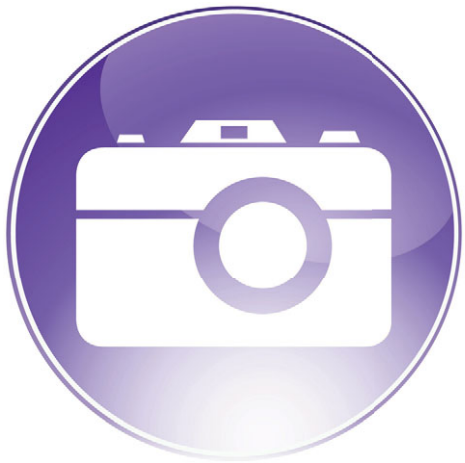
Some memory errors can occur when the modules are not securely placed in the socket. Therefore it's a good idea to occasionally open up your case and ensure that each stick is securely seated in its slot.

Fix-It Checklist

When your PC's memory is causing problems, you'll need the following things to get it fixed up.

- ✓ Phillips-head screw driver to remove side panel or laptop panel
- ✓ A functional, up-to-date copy of Windows
- ✓ Users manual for your computer

Troubleshooting Reference: DIGITAL CAMERAS



We've come to rely on digital cameras to capture the special moments in our lives. And if you miss a moment because your camera isn't working or produces poor-quality images, it can be frustrating. Here, we'll provide some quick tips for resolving a few of the most common issues.

Clean Off The Lens

So you've just snapped a few photos of the family dog, only to find that most of them have been ruined because a certain pooch left his noseprints on the lens. The same problem can occur if dust builds up or when you accidentally touch the lens with your finger. Breathing across the lens and wiping it off with a soft, microfiber cloth will remove most marks. For stubborn fingerprint oils, you may need to use a lens cleaner. Lenses typically have special coatings, so you'll want to avoid any household cleaning products that could mar the coating.

Battery Life

When you first got your digital camera, the battery lasted for several hours before it needed to be recharged. But over time, a battery wears out; eventually, it may only give you enough juice for a few shots. If you're experiencing this problem, you'll likely need to invest in a new battery. If you see a white flaky material on the old battery, it's likely that it was leaking and that residual acid has corroded the contacts. You'll need to clean the contact pads with a brush and fine sandpaper before you install a new battery.

Shots Are Dark Or Off-Color

Many point-and-shoot cameras use small image sensors that have trouble gathering enough light in low-light environments. You may be able to compensate by switching to a shooting mode in which the camera opens the shutter for a longer period of time, but then the camera must be held steady to avoid blur. It may be easier to move the subject to a location where there is more light, or to better illuminate the scene by adding more light with a flash or by opening a curtain.

Prevention

Digital cameras are fairly durable devices, but you'll want to keep them away from liquid, sand, and dirt. Liquid can short out the internal circuitry, while sand and dirt can scratch the lens and other parts inside the camera. The internal circuitry and glass lens (and internal mirror, if your camera has one) can also be damaged if you drop the camera, so remember to keep the neck strap on while using it.

Fix-It Checklist

Here are the tools you'll need when troubleshooting a digital camera.

- ✓ Microfiber cloth
- ✓ Lens-cleaning solution
- ✓ Soft brush
- ✓ Fine sandpaper
- ✓ Backup batteries

Troubleshooting Reference: NETWORKING

A down, slow, or unreliable network can lead to significant downtime and frustration. Here, we'll help you troubleshoot a few of the most common network problems.

Try The Power Cycle

When it comes to the physical network, there are two devices that can possibly fail: the router and the modem. Both have simple fixes. Turn them off, wait ten seconds or so, and turn them back on again. This "power cycling" will resolve many network issues. For example, the router may have had a problem renewing its IP address or releasing new IP addresses for the computers on your network. Restarting the router or modem resets the device's software, often solving these sorts of problems.

Examine Your Network Adapter

If that didn't solve the issue, check the PC's network adapter. The Network Diagnostic utility built into Windows 7 can renew your computer's IP address and ensure that the network adapter is enabled. To run Network Diagnostic in Windows 7, click the Start orb, select Control Panel, choose Network And Internet, and select Network And Sharing Center. Under View Your Active Networks, select the link next to Connections and click the Diagnose button. Windows will run a few tests to try and fix the problem.

Weak Wireless Signal

Watch out for nearby devices such as microwaves, Bluetooth devices, baby monitors, and phones, all of which can cause interference in the signal. Move your router someplace where it's less likely to experience interference.

Intermittent Connection

You'll want to check the physical connections to your router to see if all the cords are securely connected. A loose connection may explain why the Web drops intermittently. It's possible that the cable may have a cut or kink that causes a fault in the connection. Try replacing the Ethernet cable.

Prevention

Wireless signal interference will typically be worse if the device causing the problem is close to the router. Try moving your router or PC to a different location, where the interference will have less of an effect. (And see "Troubleshooting Reference: Wi-Fi Connection" in this section for more information.)

Fix-It Checklist

Here are the tools you'll need when troubleshooting your network.

- ✓ Extra Ethernet cable to replace bad or kinked cable
- ✓ Unused outlets for alternative locations to place wireless router
- ✓ Users manuals for routers and other networking equipment

Troubleshooting Reference: WI-FI CONNECTION

Internet connectivity has become synonymous with "smart" when it comes to consumer electronics and appliances. But if your Wi-Fi connection goes down, you might have a hard time adjusting to a Blu-ray player that just plays Blu-ray Discs, a phone that only makes phone calls, and a tablet that just plays games. Follow these Wi-Fi connection troubleshooting tips to "smarten up" your favorite gadgets.

Device Fails To Detect A Wi-Fi Network

The first thing you should do is find another Wi-Fi-capable device and attempt to connect to the Wi-Fi network. If the second device also cannot locate the SSID (Service Set Identifier), or Wi-Fi network name, then turn your attention to the wireless router. Most routers have LEDs that indicate connection status, so consult your manual and determine if the router appears to be operating normally. The manual also provides instructions for accessing the configuration menu, so check this to make sure you actually have a wireless network up and running. Reset your security password if necessary. Make sure that your router is configured to broadcast the SSID, at least while you're troubleshooting. (You may wish to stop broadcasting once the problem is resolved.) Also, check the wired devices plugged into your router to determine if the router itself is malfunctioning. Finally, restart your PC and any device that has failed to connect to the wireless network. If the connectivity issue is isolated to a single device, disabling and re-enabling Wi-Fi may solve the problem.

The Wi-Fi Network Is Working, But There's No Internet

You may need to reset your Internet connection. Unplug the wireless router and modem. Next, plug in the modem and wait ten to twenty seconds for the lights to come on and then plug in the router. If your modem has a battery backup, you may need to press a recessed button to reset it. Check all Ethernet cables for loose connections and then try to find your Wireless network with your Wi-Fi-based devices.

Prevention

A Wi-Fi network requires little maintenance. If you regularly maintain your PC, modem, router, and wireless devices, the network should continue to operate flawlessly. You may experience speed fluctuations if there are too many devices or appliances nearby that operate on the same frequency; minimize this problem by keeping your wireless router and Wi-Fi devices away from cordless phones, microwaves, wireless game controllers, Bluetooth devices, and even fluorescent lights.

Fix-It Checklist

It's helpful to have a few things on hand when your Wi-Fi network fails. Here's a short checklist that'll help you solve the problem.

- ✓ A spare device that supports Wi-Fi
- ✓ Manuals for your router and modem
- ✓ Spare Ethernet cables
- ✓ Wireless router or adapter driver discs
- ✓ Alternate Wi-Fi router
- ✓ USB Wi-Fi adapter

What To Do When

Your System Freezes

Any time your system locks up, your work is at risk, but freezing doesn't always have to end in catastrophe. We'll help you understand how to work through and recover from these issues.

General Tips

What at first looks like a freeze may just be slow processing. When in the middle of resource-intensive activities, such as editing video, burning a DVD, or copying large files, many applications and machines may appear to hang. Don't start forcing anything to close or shut anything down until you're certain it's not just taking a long time to complete the task.

As always, protect yourself against inevitable freezes and crashes by saving early and often. Schedule and confirm regular backups of important data. Don't let hardware or software problems linger—troubleshoot and repair/replace as soon as feasible. Use antivirus and anti-spyware tools to protect your system from malware.

Program Freezes

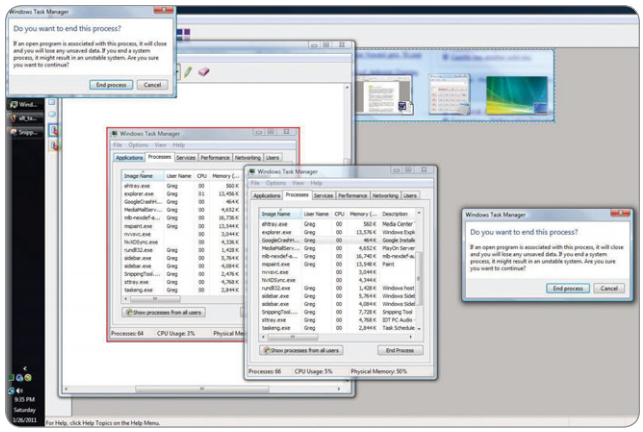
Many applications feature some sort of moving progress indicators to

let you know they're still working, but not all applications have these, and they don't always work correctly. When you think your program is frozen, use your mouse to try switching applications. Sometimes working on something else gives the bogged-down application time to recover.

If switching to other applications doesn't work, or if the mouse isn't responding, press ALT-TAB to display all of the currently open windows. Press TAB repeatedly while holding ALT to rotate through them. Simply release both keys when you reach the application you want. Switching out to another open program, either for just a moment or for a longer period, can help determine whether the application in question is responding.

If nothing else is open or if your system isn't responding to ALT-TAB, press WINDOWS-M to minimize all open applications, returning your screen to the Windows Desktop. Sometimes, this reveals a dialog box or warning message hidden beneath other open windows.

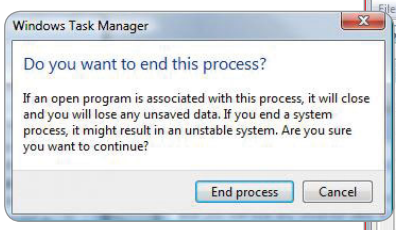
The next step is to try relaunching the offending application or opening another instance of it. It won't always work, but sometimes this nudges the system into reactivating the first open window in that program or, at the very least, lets you complete your activity within a different session.



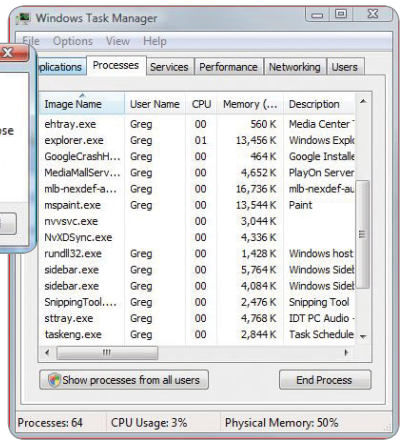
Pressing ALT-TAB may let you switch among open applications in an attempt to avoid the one that's not responding.

If nothing you do induces the application to respond, click the "X" button at the top right corner. The program may take a minute or two to close, or generate a "Not Responding" message. If you've exhausted all other options, force the application to close by clicking End Task (or similar).

If ending a program this way doesn't work, you'll have to go to the Task Manager by right-clicking the Taskbar and selecting Start Task Manager from the context menu or by pressing CTRL-ALT-DELETE and clicking Start Task Manager from the on-screen menu. Start with the Applications tab. Locate the program in question and click End Task. If that doesn't do anything after a few minutes, navigate to the Processes tab. When you find the culprit, select it and click End Process at the bottom right. Confirm any warning messages with another End Process selection. This should bring a quick end to any application that's stopped responding, but it doesn't mean your system is back to normal. At this point, it's a good idea to reboot before trying to run the application again.



The End Task dialog box, either generated from an application's Close ("X") button or from the Task Manager, may force a frozen program to close.



The Windows Task Manager provides detailed access to all open applications and processes, providing access to a forced End Process or Log Off option.

System Freezes

Full system-wide freezes can be a little more difficult to figure out. For one thing, it's hard to identify a single application or process at fault if you're multitasking when things go awry. It's also harder (by definition) to navigate and investigate when nothing is responding, including Windows itself. Start by looking for signs of life that might indicate the system is processing and not frozen. Good indicators include flashing activity lights, the whir of a churning hard drive, or indicator icons and bars that move only infrequently. If it looks like things might actually be moving, wait a little longer.

After The Thaw: Recover From A Freeze

System frozen? Try these steps to quickly get your system back up and running again.

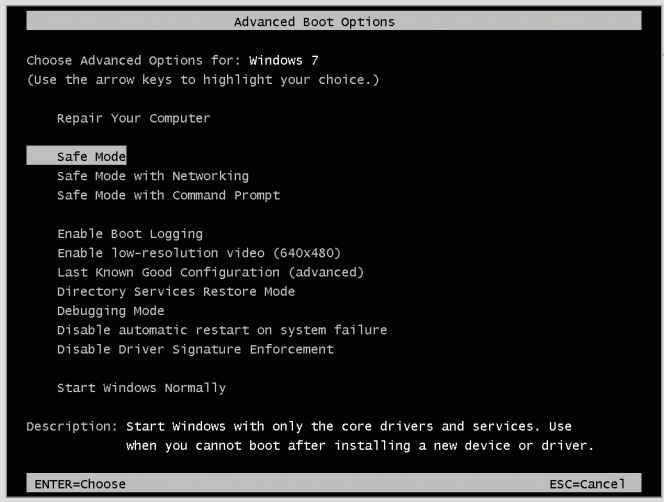
Reboot. Even after closing an application, your memory or other processes may have become corrupted. Be safe and restart the system.

Safe Mode. If you shut down the system without using the Windows Shutdown option, boot up in Safe Mode. Windows will often prompt you after a system crash, or you can press F8 during the boot process for a menu with the option to boot into Safe Mode. Then just restart the system before proceeding.

Recover data. If you had to close out in the midst of working on something, your in-progress data may be lost. But you may be able to recover at least part of your files. Microsoft Office will often AutoRecover documents after a crash, and temporary or archived files may provide some assistance.

Watch out. Keep a close eye on the system's performance and your usage for a while, so that if a freeze recurs, you can detect a pattern and, hopefully, identify the cause.

Save early, save often. Freezes can happen at any time, without warning. Make a habit of saving your work regularly. Don't forget to schedule and verify regular system backups, as well.



After a freeze, boot back up into Safe Mode before restarting normally.

When signs of life cease, or when you run out of patience, try a few simple navigational tricks. Use the ALT-TAB shortcut as previously described to see if anything happens. Try other keyboard shortcuts such as WINDOWS-M (minimize all) or WINDOWS-D (show the Desktop). Disconnect and reconnect your mouse and keyboard. You can also try removing peripherals not in use, such as portable drives, printers, or other devices. Try removing any recently added hardware. USB drives, especially older ones, are notorious for creating resource conflicts that can bring a system to its knees.

If the system is still not responding, you're left with little choice but to shut it down. Take the gentle route first. Press CTRL-ALT-DELETE and see if you can get to a Log Off or Task Manager window. Or try to get to the Start menu with its shutdown options, either via the mouse or by pressing the WINDOWS key. Next, press ALT-F4 to close the currently active application or shut down the system. If your machine has Shutdown, Standby, or Restart keyboard buttons (as many notebooks do), try using them. Additionally, many desktop cases have a Restart button built into the front. Finally, if nothing else works, press and hold the Power button to shut the machine down. Avoid pulling the plug or removing the battery if at all possible.

The CTRL-ALT-DELETE keyboard shortcut may not work when the system freezes, but it's worth a try before shutting everything down.

Tips From The Help Desk

Common Tech Questions

USB memory card readers are an easy way to add memory card connectivity to your computers.

SD cards are the most popular storage format found on today's mobile devices.

Q: What's the easiest way to add memory card reader capabilities to my desktop PC?

A: Memory card readers certainly simplify the image or document transfer process. Just insert your memory card into the reader, open Windows Explorer, select the drive for memory card reader (typically titled Removable Disk), and copy the files to the desired folder on your PC.

External memory card readers are available in a wide variety of shapes and sizes. Some models will accept nearly every type of memory card. Other external card readers are designed with portability in mind and only read one or a few types of memory cards. For instance, you may find some flash drive-sized external card readers that only accept SD (Secure Digital) or SDHC (Secure Digital High Capacity) formats. For convenience, many portable card readers feature an integrated USB plug, so you don't need to use a cable to connect the reader to your PC.

If you're in the market for a printer, consider a model that includes an integrated card reader. Photo printers commonly offer memory card slots to let you print photos without the need for a PC, and you can also use the printer's memory card slots to transfer files to or from your memory cards. You might also consider an internal memory card reader, which provides a clean look by installing into a free drive bay at the front of your desktop PC. Typically, internal card readers are designed to fit into 3.5-inch bay openings (the same size as a 3.5-inch diskette drive), rather than the full-size 5.25-inch bays. If your PC only offers 5.25-inch bays, you can purchase an adapter and cover for a 3.5-inch card reader.

Whatever you choose, ensure that the memory card reader supports the type of memory cards found in your portable devices. Most modern portable devices use some type of SD slot. SD cards are available in SDSC (up to 4GB), SDHC (between 4GB and 32GB), and SDXC (32GB and above) options. MicroSD cards can be found in capacities up to 64GB.

Q: What are the differences between the types of D-SLR lenses, such as telephoto, wide-angle, and macro?

A: Telephoto lenses provide the long-range zoom capability you need to shoot faraway subjects. A telephoto lens also creates a shallow depth of field that blurs objects in the background and foreground, which helps highlight the in-focus area of the photo. It's ideal for capturing portraits and other images where you need to separate objects from the background. A wide-angle lens delivers a more panoramic view than

SDHC memory cards will store more than 4GB of content.

A telephoto lens allows people to get crisp close-ups from a distance.

other lenses. Because you can frame a larger portion of a scene, the wide-angle lens is perfect for shooting scenic landscapes, as well as tight indoor spaces where a normal lens can't capture the entire room. Wide-angle lenses also provide a large depth of field, so it's easy to keep the entire image in-focus.

If you enjoy photographing the small things in life, such as flowers and butterflies, you should consider a macro lens. This type of lens is designed to let you sharply focus on tiny objects, including subjects within inches of the camera lens. Macro lenses magnify a subject, sometimes two to four times life-size, to provide a perspective that you wouldn't otherwise see. Those who want to mimic the perspective of human vision—popular for candid and nature photography—should consider a "standard" lens that provides a fixed focal length of around 50mm. The key concern with a standard lens is that you can't zoom in or out, so you'll need to move to frame the shot.

Q: Can I use my film-camera SLR lenses on my digital SLR?

A: You'll need to see if your D-SLR offers the same type of mount (the connector between the lens and camera) as the lens. If so, you *may* be able to use the film camera's SLR lens on your D-SLR, but it may not take complete advantage of the features on your D-SLR, such as the camera's autofocus, light-metering, flash synchronization, and image stabilization capabilities. Additionally, most D-SLRs have smaller image sensors than their film companions, which causes the SLRs lens to deliver greater telephoto range and less of a wide-angle view than the lens would have delivered on your film camera.

Q: Can I ditch my laptop and work exclusively on a

Because you can frame a larger portion of a scene, the wide-angle lens is perfect for shooting scenic landscapes, as well as tight indoor spaces where a normal lens couldn't capture the entire room.

A wide-angle lens lets you capture more of a scene.

Depending on your needs, you may be able to use only your smartphone while traveling for business.

smartphone or tablet when traveling for business?

A: Many business travelers now rely on a smartphone the way they once relied on a laptop to get work done outside the office. And with recent advancements in screen size, mobile broadband, and processing power, today's smartphones and tablets allow travelers to get work done nearly as efficiently as they can in the office. The key consideration for most people is whether there are mobile applications available for everything you'll need to do when you travel. With a little searching, it's likely you'll be able to find an application that will do what you need. But will it allow you to work efficiently enough to get the job done in a timely manner?

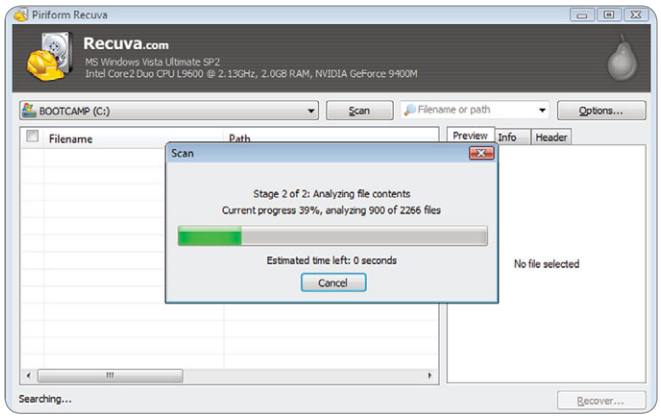
If precise data entry is important and must be done on the road, business travelers could invest in a portable keyboard. A wide variety of Bluetooth keyboards are available, and some include extra features, such as full-size USB ports and enhanced battery life. Music fans will note that most current phones support Bluetooth's A2DP (Advanced Audio Distribution Profile), which allows your smartphone to send stereo music over a Bluetooth headset and eliminates the need to bring a portable media player or headphones.

Even though smartphones and tablets have become much faster in the last few years, it's unlikely the mobile application will respond as quickly as a comparable program would on your laptop. People whose jobs require the use of complex software, such as that used by managers, graphic designers, or videographers, may find themselves losing time waiting for a mobile device to process data if they ditch the laptop. But if all you need to work on the road is Web and email access, a smartphone or tablet will likely be enough. In most cases, it'll come down the nature of your job.

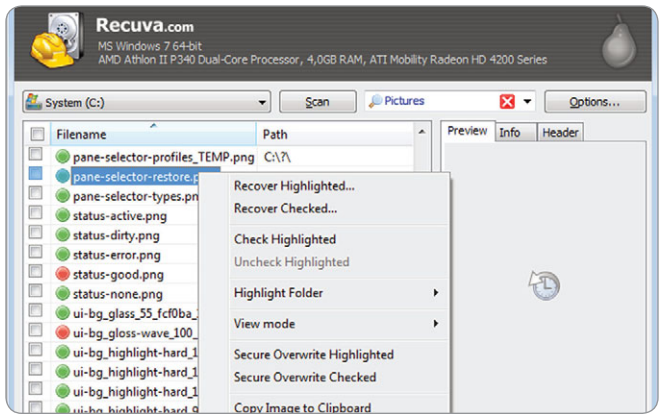
With recent advancements in screen size, mobile broadband, and processing power, today's smartphones and tablets allow travelers to get work done nearly as efficiently as they can in the office.

Recover Deleted Files

Don't Panic. . . Yet



Recuva is an example of a free file recovery utility that lets you scan whole drives or search specific directories.



If you know the type of file you're looking for, you can often narrow your search parameters to find them quickly.

Few computer-related mishaps can be more devastating than the accidental deletion from your computer of something—or many somethings—that are important to you. Before you panic, know that there's a very good possibility that your files can be recovered. In this article, we'll walk you through a few procedures that could help you undo your unintended deletions.

Gently Apply The Brakes

When you think you've deleted something by accident, the first thing you should do is *stop using your computer*. Don't install updates, launch programs, or create new files. Don't even save the work you're working on, if you can help it.

Files you've temporarily deleted (we'll talk about these in a minute) are the easiest to recover. The more difficult files to recover are those that have been "permanently" deleted, at least according to the operating system. When you permanently delete something, Windows doesn't actually obliterate it like you might imagine; instead Windows removes the file record marker and leaves the file itself fully intact. The reason it's important to stop what you're doing as soon as you discover your inadvertent action, is because Windows designates the home of your deleted file as ready for paving over; the next time your computer writes any data to the hard drive, there's a chance it'll overwrite the file you didn't intend to delete. Once that happens, even the forensic experts may have difficulty raising your files from the dead. But before we look into how to recover permanently deleted files, let's make sure you didn't just perform a temporary deletion.

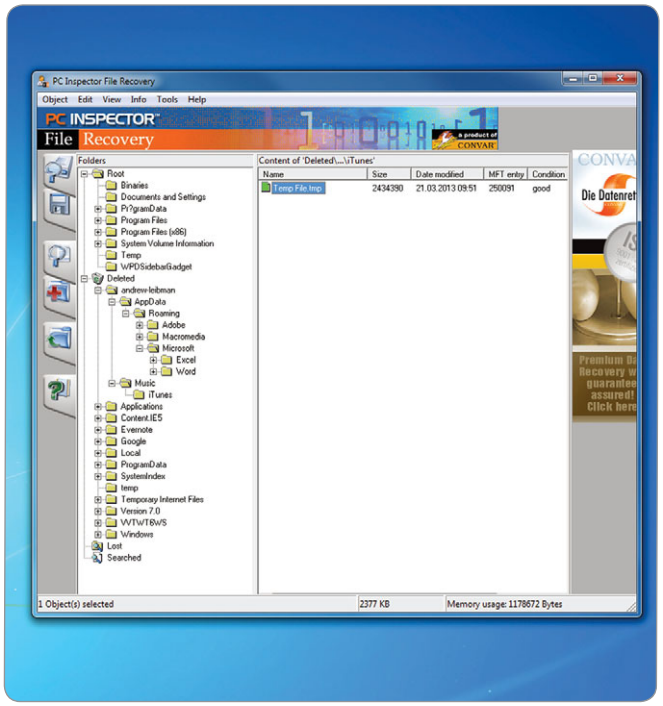
Say It Ain't So

Files you drag and drop into the Recycle Bin or on which you right-click and select Delete, aren't permanently deleted; as a result, they can often be the easiest to recover. To see if your missing files simply made their way to the Recycle Bin, double-click it from the Desktop to view the files therein. If you find any files you'd rather hang onto, right-click the files individually and click Restore. This places the file in the folder in which it existed before it was sent to the Recycle Bin. You can also drag files you want to rescue out of the Recycle Bin and onto your Desktop.

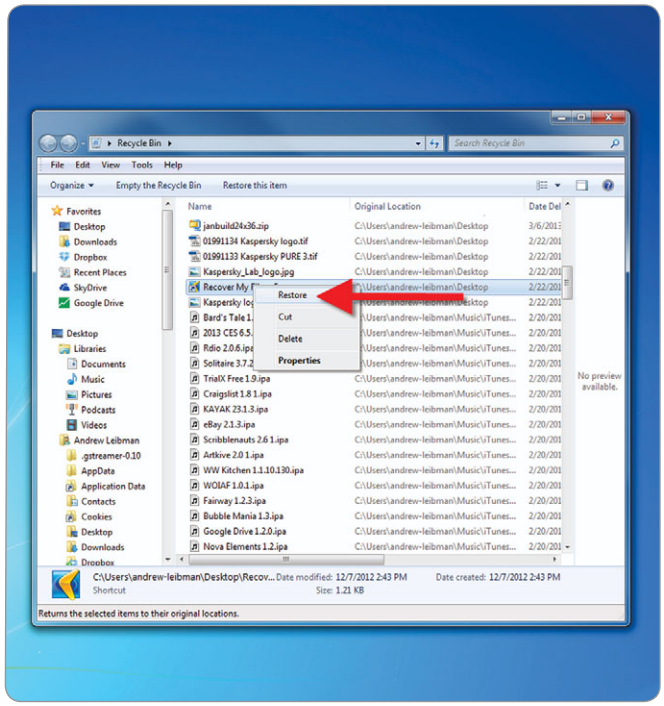
If you've scanned the Recycle Bin but can't find the files you need to recover, then check to see if the file has just been moved. Explore folders in and near the folder you were working in to see if you accidentally misplaced it. The Rename option is also within close proximity of the Delete operation, so check to make sure you didn't accidentally rename the folder or file you "misplaced."

Undo "Permanent"

Windows considers files that you actually watched blink out of exis-



Most file recovery utilities, like the freeware PC Inspector utility, let you browse recovered files in a familiar directory tree layout.



Items sent to the Recycle Bin are some of the easiest to recover. Just right-click and click Restore.

tence, i.e., those that didn't reappear in the Recycle Bin, to be "permanently deleted." These files can still potentially be recovered, but you'll need third-party software to do it.

One of the best ways to find this kind of software is to perform an Internet search using the key words "file recovery" and "restore deleted files." The utilities you will find all generally work the same. Once installed on your computer, the utility will scan your storage for recoverable files and then display any it finds. Some categorize the results by type, others simply show them with their file extensions, leaving you to determine that MP3s and WAVs are songs, DOCs and TXTs are documents, and MOVs and MP4s are videos. Then all you need to do is highlight or select the files you want to recover and click the appropriate execution button. For the most part, these utilities will put the files into a new folder on your Desktop, so you can easily access them.

Drive Recovery

The most basic form of file recovery these types of utilities perform is whole drive recovery. This will discover every recoverable file that was retrieved from the drive in question. For instance, if you run it on the C: drive, the utility will scan the entire drive and find recoverable files from all of your drive C: folders. Typically, scanning an entire drive will take time. Depending on the size of the drive, it could take hours. And when the search is finished, it'll display a bunch of data and files you don't care to recover. (It's unlikely that you need to recover files from the Temp folder.) Sifting through all these extraneous recovered files to find what you need can be difficult and time-consuming.

Directory Recovery

If you can narrow the search range slightly, you may be able to perform the search much more quickly. Most of these types of utilities let you perform directory searches, so you can scan for recoverable files in just the Documents folder, for instance.

Targeted File Recovery

Your best bet when using file recovery software is to simply input the name of the file you misplaced or deleted. Although the recovered file may not retain the exact name for which you're searching, it can get you close enough to find your file. Some utilities offer the ability to search for a given file type, such as photos or text documents, which can save even more time.

Last Resort

If the file recovery utilities you tried don't work, there are numerous organizations that specialize in professional file recovery. If the hard drive is corrupted or damaged in a fire, flood, or other incident, these folks may be your only hope.

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